

PUBLIC WORKS

CITY

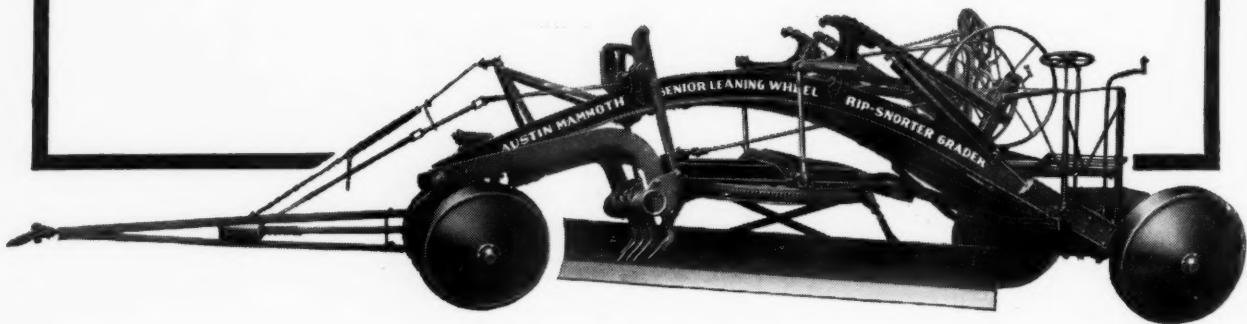
COUNTY

STATE



JULY, 1931

Unsurpassed for sheer "workability"



Austin Mammoth Senior Leaning Wheel Graders with Rip Snorter Scarifiers set new records for efficient, low cost, labor-saving operation . . .

WEIGHT—rugged strength—ability to do the "dirtiest" and toughest jobs—such are the qualities that set these famous combination graders and scarifiers apart from all others of their kind.

Doing work in a single operation that formerly required several laborious and costly operations is typical of the advantages that all Austin-Western Road Machinery holds for road builders. The model illustrated has a twelve-foot blade—disc wheels with removable rims and two-piece, telescopic rear

axle. It will work behind the most powerful tractors and tear up worn-out road or rough subgrade and regrade in a single operation. Such *special advantages* enable road officials to make better records and contractors to cut costs.

Now is the time to find out just what this amazingly complete line has to offer for 1931. Send for full descriptions and specifications for your files—today! The Austin-Western Road Machinery Co., 400 N. Michigan Ave., Chicago, Ill. Branches in principal cities.



Austin-Western ROAD MACHINERY



A Galion E-Z Lift Motor Grader is shown (left) blading oil-mixed aggregate on a section of road. The two Galion Graders shown below are also working a similar section. Depending on the job, from one to three of these graders are used.

For Strenuous Blading.....

..look to the



GALION

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ALABAMA, Birmingham—G. C. Phillips Trac. Co., Inc.
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COLORADO, Denver—H. W. Moore Equipment Co.
CONNECTICUT, New Haven—Power Equip. & Service Co.
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LOUISIANA, New Orleans—Louisiana Road Mchy. Co.
MAINE, Portland—Eastern Tractor Co.
MASSACHUSETTS, Cambridge—Eastern Tractor Co.
MICHIGAN, Lansing—Hubbard Equipment Co.
MINNESOTA, St. Paul—Borchert-Ingersoll, Inc.
MISSOURI, St. Louis—O. B. Avery Co.
Springfield—R. L. McDonald Equip. Co.
MONTANA, Butte—Hall Perry Machinery Co.
NEBRASKA, Omaha—Interstate Mchy. & Supply Co.
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WEST VIRGINIA, Huntington—Banks Miller Sup. Co.
Welch—Welch Good Roads Sup. Co.
WISCONSIN, Milwaukee—Badger Trac. & Equipment Co.

E-Z Lift Motor Patrol Graders. Sturdy, dependable and powerful machines for road maintenance—working oil-mix roads, reducing sub-grades, maintaining berm beside surface roads, etc.

Galion E-Z Lift Motor Graders are being used extensively on resurfacing jobs where large quantities of oil-mixed aggregates must be thoroughly bladed and accurately graded.

These graders get over the road quickly and are easily maneuvered.

Furnished with McCormick-Deering, Allis-Chalmers, Case or Cletrac tractors, and with your choice of mountings—single or dual pneumatic or solid rubber tires; steel wheels, Sure-trac rubber crawlers; or steel crawlers.

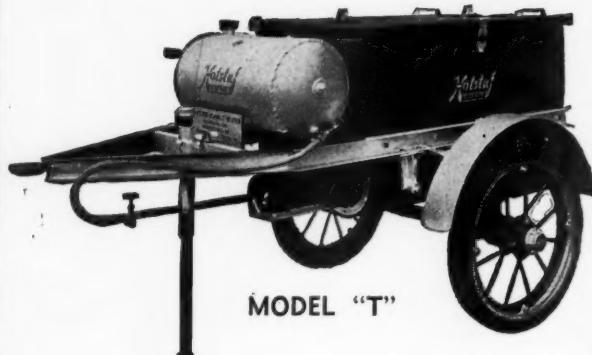
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Galion, Ohio**



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The Only Heater With the Patented Elevated Melting Chamber Feature:

QUICK ACTION. The hottest flame is under the melting chamber and as fast as the asphalt melts it runs down into the melted chamber, leaving the melting surface clean of sediment and in direct contact with the cold material. The long heat travel passes under the already melted material heating it up to the desired working temperature.

NO COKING. The elevated melting chamber eliminates overheating the already melted material and forming a coke with the sediment. This cannot be prevented in the round bottom kettle.

NO WAITING. The melted asphalt never comes in contact with the cold asphalt, so that reloading of the heater never lowers the temperature of the hot asphalt.

MAXIMUM EFFICIENCY. The absence of coke and melted asphalt on the melting surface eliminates an insulation through which the heat must travel to reach the cold material to be melted, giving maximum efficiency in melting and heating and prevents burning out of kettle bottoms.

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With Our Authors



C. W. SMEDBERG, director of Public Works and Service, Greensboro, N. C., was graduated from the Engineering School, University of Michigan with degree of B. C. E. in 1915. Employed as inspector in City Engineer's office, Ann Arbor, Michigan, 1915-1916. From 1916-1918 with Hood and Decker, Consulting Engineers, Ann Arbor, Michigan, as assistant engineer on preliminary surveys, reports, designs, and construction of water supply, sewerage and sewage disposal projects, later superintendent of water and city engineer, Muskegon Heights, Michigan, in charge of water, sewers and street department. From 1918 to 1919 assigned to Camp Wadsworth, S. C., in charge of water supply. On discharge made superintendent of plants, Spartanburg, S. C., Water Department. From 1919 to January, 1924, principal assistant engineer, Carolina Engineering Co., Wilmington, N. C., on reports, design and construction of water, sewage, street and general municipal projects in Virginia, South Carolina, and North Carolina. From January, 1924, to November, 1931, superintendent of Water and Sewer Department, City of Greensboro, N. C., November, 1931, to date director of Public Works and Service.



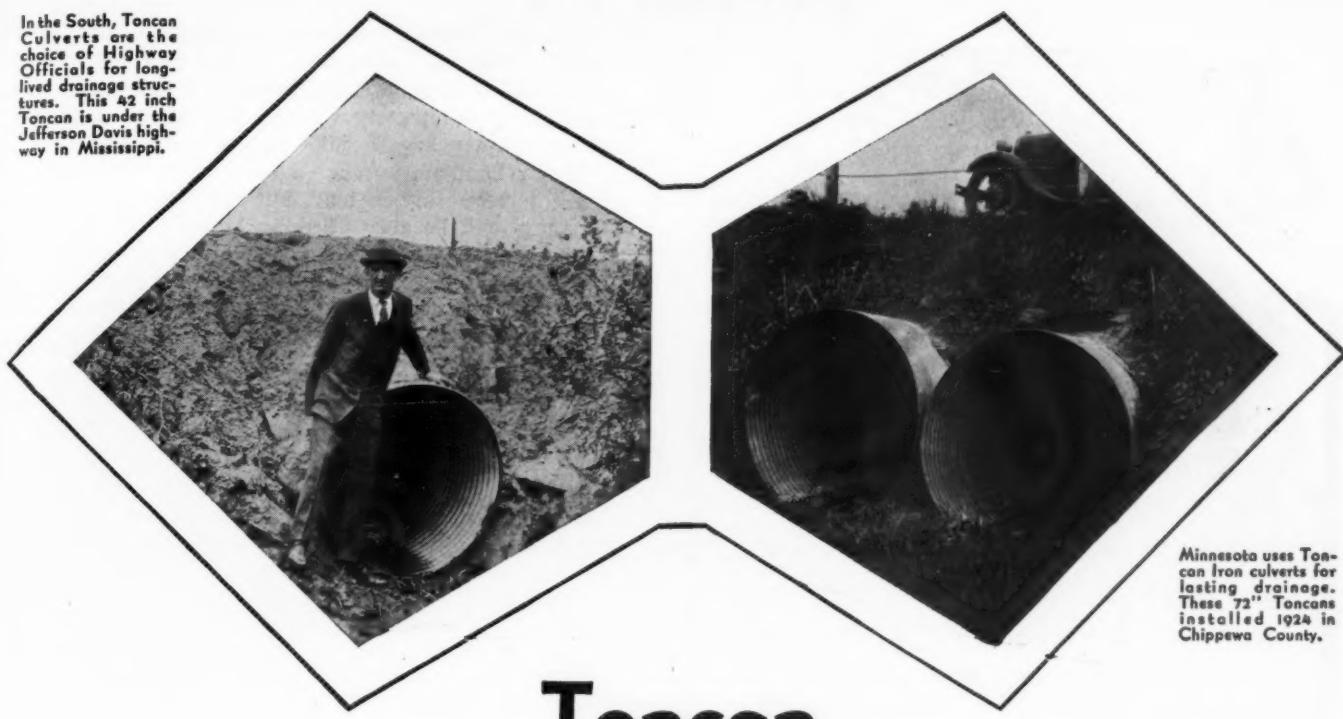
ELLIS IRVING CRONK, who is the author of the article describing the new pumping plant at New Brunswick, N. J., has been engaged in newspaper work in and around New Brunswick. He attended Syracuse University and Rutgers, where he studied journalism. His article is especially valuable and timely, in that it shows how cities can save money by replacing old and uneconomical machinery with modern equipment. The data on costs are worthy of careful study by those responsible for operation of similar plants elsewhere.

Books and Pamphlets

Military Preventive Medicine.—By George C. Dunham, M.A., M.D., Dr. P. H., D. T. M. & H.; Major, Medical Corps, U. S. Army; Director, Department of Sanitation, Medical Field Service School. 1062 pages, 252 illustrations. Published as Second Edition, Army Medical Bulletin No. 23.

The first edition of this excellent text was reviewed in PUBLIC WORKS for October, 1930, and our readers are referred to that issue for detailed information as to what is covered. We will merely repeat here our previous statement that this is incomparably the best

In the South, Toncan Culverts are the choice of Highway Officials for long-lived drainage structures. This 42 inch Toncan is under the Jefferson Davis highway in Mississippi.



Minnesota uses Toncan Iron culverts for lasting drainage. These 72" Toncans installed 1924 in Chippewa County.

Toncan culverts meet all requirements

What type of culvert will stand shipping and rough handling without breakage,—is the easiest and most economical to install,—will successfully withstand constant expansion and contraction, together with the weight of deep fills, sharp impacts and vibration? Toncan Iron Corrugated Culverts meet all of these requirements, and in addition possess unusually long life.

Innumerable tests have proven that Toncan Iron has greater resistance to solution, hence to rust and corrosion, than any other corrugated culvert metal. Why? Because Toncan Iron is the only alloy of pure iron, copper and molybdenum used in corrugated culverts today. Write for booklet.

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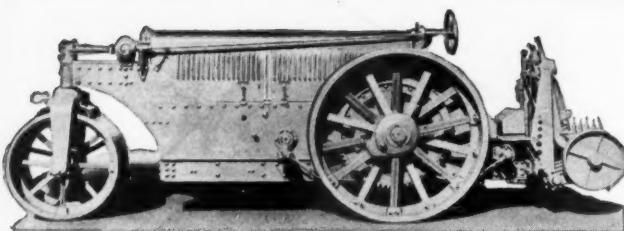
Plants Located in All Parts
of United States and Canada

TONCAN
Copper - Molybdenum
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CULVERTS

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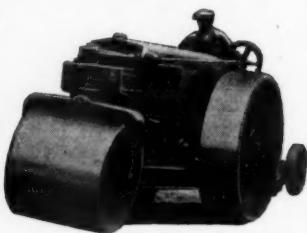
Railroads Sanitary Sewers Golf Courses Suburban Gutters Storm Water Sewers Aviation Fields Highways

For latest catalogs—consult the *classified INDUSTRIAL LITERATURE* section, beginning on page 83



Rugged-Reliable-Modern

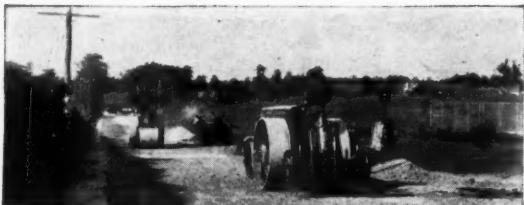
That the Buffalo-Springfield Roller really has extra years of service built into it is a fact that becomes readily apparent upon close inspection. Nothing that specialized manufacture considers desirable, or that the most exacting buyer demands is lacking. Aside from the incorporation of the latest worthwhile features these rollers are fabricated with strength, ruggedness, and in consequence, with long life ever in mind as a major consideration.



Built in every practical weight and size, both steam and motor driven, three wheel and tandem. Scarifier and other attachments optional.

Write for illustrated booklet

**The Buffalo-Springfield
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SPRINGFIELD, OHIO



**Buffalo-Springfield
ROLLERS**

and most complete text-book on public health engineering that we know about. The first edition of 2,000 copies is gone. The second edition which has been pretty completely revised, and has a couple of added chapters, is of 5,000 copies.

Major Dunham is now en route to the Philippines for a foreign service tour, but his place at Carlisle Barracks will be ably filled by Major C. G. Souder. Perhaps those who haven't been fortunate enough to get copies of the first edition of this text will find it possible to get one now through Major Souder.

Principles of City Planning.—By Karl B. Lohman, Professor of Landscape Architecture, University of Illinois. 1st Edition. 153 illustrations, 95 pages. McGraw-Hill Book Co. \$4.

This volume is intended for the teacher and student of city planning and for members of zoning or planning commissions. It should also prove helpful to anyone interested in the improvement of his community.

The scope is wide. Beginning with an historical outline of the movement, there are covered, in their relation to city planning, streets and street systems, traffic and its control, transit and transportation problems, sea, lake and river ports, airports, park and park systems, playgrounds, housing, zoning, public buildings and building groups, the city beautiful, regional planning, and, finally and perhaps most important in these days, paying for city improvements.

Armco Storm Sewers.—The use of storm sewers for draining business and residential sections; for bringing new subdivisions up to city standards; drainage of industrial property; and for enclosing open streams; and how to install them, are fully described and amply illustrated with photographs of actual jobs, in the new 24-page catalog, "Armco Storm Sewers," now ready for distribution by the Armco Culvert Manufacturers' Association, Middle-town, Ohio.

According to the evidence presented by this catalog, Armco storm sewers have ample strength to resist the load and impact of the heaviest traffic, the enormous pressures of frost action and the tendency to disjoint and disintegrate caused by shifting and unstable foundations. Their strength, as shown in experiments and installations mentioned, lies in their ability to "flex" and thereby distribute the load uniformly around the entire pipe.

Modern conditions no longer permit city streets to be dug up at will. This catalog tells the part Armco storm sewers play in the elimination of this costly practice. It also tells why they command the respect of city official, taxpayer and property owner, and of their simplicity, ease and low cost of installation, and their dependability and durability.

A complete description of Armco storm sewers, the requirements they meet, their varied application and advantages, together with complete instructions for ordering and installing, make this catalog a valuable booklet for any one confronted with the selection of storm sewers.

New Book on Concrete Handling.—The successful use of belt conveyors on a variety of concrete construction jobs from the world's largest building to a two-story church is described and illustrated in "Concrete Handling" a new book printed and made available through the Barber-Greene Company of Aurora, Illinois.



Winding roads again beckon us to countless spots of natural beauty in town and country.

Dustless Roads are Priceless yet they cost so little to maintain—

Please don't let dusty roads spoil our out-of-doors pleasures. A couple of Calcium Chloride treatments will not only lay dust during the entire season, but will make these roads more compact and nearly as smooth to ride on as pavements.

Many thousand miles of gravel and crushed stone roads are so treated each year. And the low-cost Calcium Chloride is often more than paid for by the road surface

materials it prevents from being blown away in dust. Investigate Calcium Chloride. It's the most economical, the most satisfactory dust layer on the market today. Send the coupon now for facts.

Calcium
Chloride
Publicity
Committee

Send this coupon to any one of these companies:

The Dow Chemical Company, Midland, Michigan
The Columbia Alkali Company, Barberton, Ohio
Solvay Sales Corporation, 61 Broadway, N.Y.C.

Without obligation please send complete information on
Calcium Chloride for dust laying.

Name _____

Address _____

Position _____

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CALCIUM CHLORIDE

"makes roads moist, dustless and compact"

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**TODAY &
RIGHT NOW
HERCULES IS
& THE BEST &**

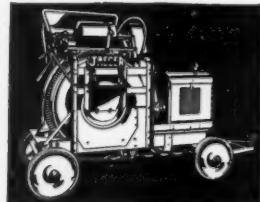
Road roller leadership based on yesterday's performance and design means nothing today -- It is today's performance, the ability to meet present day needs with speed, power and flexibility to out-work and out-last ordinary rollers that has won HERCULES the foremost position in the road roller field.

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PUMPS: Increased capacity and power, reduced weight, lower prices. All sizes, types. 2" Self-Prime 10,000 g.p.h. Centrifugal. \$177.50 f.o.b. factory.

HOISTS: Timken Screw Thrust type, powerful, fast, easier to operate. Single or double drum; gas, electric.

TOWERS: and placing equipment for every job. Jaeger-Lakewood is most complete line of its kind.

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Catalog
1931 prices!**



**THE JAEGER MACHINE
CO.** 400 Dublin Avenue, Columbus, Ohio

When writing, please mention PUBLIC WORKS

The handling of concrete and other building materials over belts on such nationally known construction jobs as the Detroit-Windsor Tunnel, the Marshall Field Merchandise Mart, the Mississippi River lock between St. Paul and Minneapolis, and the Travel and Transport Building of the Chicago World's Fair, is described. The construction work shown covers the building of dams, locks, walks, sewers, tunnels, bridges, pavements, stadiums, viaducts, buildings, foundations, retaining walls, irrigation ditches, railroad elevations, and sewage disposal plants.

One interesting job described is the building of an underpass under the Southern Pacific Railroad main lines at Houston, Texas. Here limited working space required concrete to be carried across the railroad tracks without interfering with the passage of fast freight and passenger trains. The concrete was elevated on a conveyor to a height to give sufficient clearance to trains and was chuted across the tracks to the forms.

Another job shown is the construction of a factory in Chicago on which seven conveyors saved \$108.00 per day, finishing the five story building five months ahead of schedule.

Besides the descriptions on jobs, the book contains engineering specification data on the Barber-Greene light type, and the Barber-Greene heavy duty concrete conveyors.

"Concrete Handling" is attractively bound and in addition to the copy matter, contains more than a hundred illustrations of various conveyor applications and features. Copies of this book may be secured by application to the Barber-Greene Company, Aurora, Illinois.

Culvert Uses—The use of corrugated pipe for culverts, stream crossings, road drainage, bridge replacement, entrance crossings, and other related uses, and how to install them, are fully described and amply illustrated with photographs of actual jobs in a new 24-page catalog, "Armco Culverts," now ready for distribution by the Armco Culvert Mfrs. Association, Middletown, Ohio.

According to this catalog, Armco culverts, because of their simplicity lend themselves to rapid execution of public or private improvements. Light weight, long units, non-breakability and easy assembly, permit quick, convenient and economical installation of these culverts and drains. Since 1906 they have been made continuously of Armco Ingots of Iron.

Blue-prints and photographs show how these culverts have been successfully used. A page is devoted to capacity and sizes. Figures on drainage areas are given, as are quotations from statements of actual users regarding results obtained with this product.

A complete description of Armco culverts, the requirements they meet, their varied applications and advantages, together with complete instructions for ordering and installing, make this catalog a valuable booklet for any one confronted with the selection of culverts.

Non-Clogging Pump—A non-clogging centrifugal pump for handling sewage and also with a wide application to many processes in industrial plants is described in a bulletin which has just been published by Morris Machine Works. The design includes several special features which are fully explained in the bulletin. Among the illustrations are views of

WILLIAMSPORT *wire rope..
on its outstanding merit*

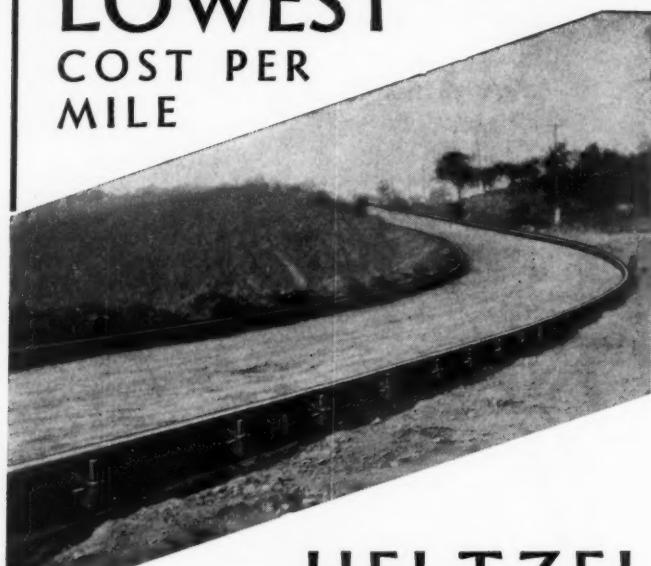
We ask you to try this rope
on your next replacement.
Let our engineers advise
with you as to grade and
construction.

It's worth *knowing* what
Williamsport service means.
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HELTZEL SUPERIOR LOCK ROAD FORMS

MORE than twenty important features of construction are combined to make HELTZEL Superior Lock Road Forms unusually strong, durable, and long-lived. Only HELTZEL incorporates all of these features in road form design. Because of this extra-strength, Superior Lock Road Forms will build a maximum mileage of concrete road with extremely low up-keep costs. Rails will not become bent or twisted, stake pockets will not come loose, and form-setting is faster and easier.

Write today for literature giving full details about HELTZEL Superior Lock Road Forms.

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OTHER HELTZEL PRODUCTS

Portable Batching Plant
Stationary Bins
Bulk Cement Plants
Weighing Batchers
Travelling Bridges
Hand Screeds
Trail Graders
Straight Edges
Hand Floats

an assortment of objects such as blocks of wood, rags, clothing, sticks, etc., which have passed through one of the pumps without clogging, and the enclosed impeller of a 10-inch pump from which is shown emerging an 8-inch diameter wooden ball, after passing through the water passages from the suction intake. The test curves of a typical pump are presented, showing an efficiency of more than 80% over a range from 67% to 120% of normal capacity. These pumps are built for both horizontal and vertical shaft installations in a range of sizes from 3-inch to 42-inch and for any type of drive. Copies of this bulletin may be obtained by addressing Morris Machine Works, Baldwinsville, New York.

Highway Construction Costs

TOWN OF GROTON, CONN.

2½" Bit. Macadam on 5½" Stone Base. L.—2493.1

Bids Received March 2, 1931

Items	Unit	Quant.	^a Unit	^b Unit	^c Unit
No. Working Days at Clearing and Grubbing	L.S.	\$20.00	30	30	20
Earth Excavation	C.Y.	830	1.25	.90	1.00
Rock Excavation	C.Y.	280	1.25	4.00	4.50
Formation of Subgrade	S.Y.	6,635	.10	.025	.03
Shape Slopes & Shoulders	L.F.	2,500	.05	.05	0.3
Gravel Fill Subbase	C.Y.	200	1.00	2.00	1.00
Broken Stone	Tons	3,450	2.50	2.75	3.00
Apply Bit. Material	Gals 17,000	.05	.07	.06	
Spec. Class "A" Conc.	C.Y.	5	25.00	35.00	25.00
Class "B" Concrete	C.Y.	5	20.00	25.00	25.00
Catch Basin	Each	1	70.00	80.00	80.00
Install 18" R.C.P.	L.F.	48	1.00	1.00	1.00
Plain Cobble Gutter	S.Y.	25	1.00	.70	1.50
Plain Conc. Curbing	L.F.	50	1.00	.80	1.00
Reset Curbing	L.F.	270	.50	.20	.40
Wire Rope Railing	L.F.	100	.75	.62	.60
Single Posts	Each	10	1.00	1.00	2.00
Plain Cement Sidewalk	S.F.	225	.40	.30	.30
6" Gravel Walk	S.F.	315	.05	.20	.20

\$13,394.75 \$14,777.38 \$15,193.05

(a) F. D. Miller; (b) Nickerson Construction Co.; (c) Benvenuti.

TOWN OF WINDHAM, CONN.

Natchaug River Bridge

136' Span Conc. Enc. I-Beam Br. & 8" 20' Reinf. C. P. L.
2225.9'

Bids Received March 2, 1931

Items	Unit	Quant.	^a Unit	^b Unit	^c Unit
No Working Days at Clearing and Grubbing	L.S.	\$30.00	60	90	90
Earth Excavation	C.Y.	1,587	.50	.30	.40
Rock Excavation	C.Y.	100	.60	4.00	2.00
Wet Excavation	C.Y.	840	4.50	6.00	4.50
Borrow	C.Y.	9,173	.30	.40	.35
Formation of Subgrade	S.Y.	4,644	.01	.05	.05
Shape Slopes & Shoulders	L.F.	2,090	.01	.05	.05
Gravel Fill Subbase	C.Y.	200	.75	.50	.60
Broken Stone	Tons	50	4.00	2.75	2.50
Concrete Pavement	C.Y.	1,007	7.00	7.00	7.00
Ba. Mat Reinf.	S.Y.	4,533	.20	.25	.28
½" Pre. Exp. Joint	L.F.	700	.10	.10	.15
¾" Pre. Exp. Joint	L.F.	2,090	.10	.06	.10
Class "A" Concrete	C.Y.	369	21.00	22.50	19.00
Class "B" Concrete	C.Y.	811	11.00	15.00	13.00
Deformed Steel Bars	Lbs.	42,536	.03¾	.04	.04
Steel Fabric	S.Y.	1,149	.25	.15	.17
Cement Rubble Masonry	C.Y.	25	8.00	10.00	12.00
Catch Basins	Each	2	70.00	65.00	60.00
Structural Steel	Lbs.	307,541	.03½	.028	.04
Phosphor Bronze	Lbs.	385	.40	.40	.50
Install 15" R.C.P.	L.F.	84	1.00	1.00	.80
Install 18" R.C.P.	L.F.	86	1.00	1.00	1.00
Install 36" R.C.P.	L.F.	50	3.00	2.50	2.00
Timber Piles 45° to 65°	L.F.	5,555	.40	.35	.25
Timber Piles up to 45°	L.F.	4,000	.25	.35	.25
Driving Timber Piles	L.F.	9,555	.35	.30	.40
Waterproof Painting	S.Y.	277	.50	.40	.40
Concrete Curbing	L.F.	125	1.00	1.00	1.00
Conc. Bridge Rail	L.F.	276	56.00	8.00	8.00
Wire Fence	L.F.	1,000	.15	.15	.20
Wire Rope Railing	L.F.	2,750	.40	.45	.60
Single Posts (Cable)	Each	21	1.00	1.00	1.00
6" Gravel Sidewalk	S.F.	600	.20	.10	.05
1" Pre. Exp. Joint	S.F.	165	.30	.50	.25
Fur. & Drive Test Pile	L.S.				
Conc. Wearing Surface	S.Y.	454	.50	1.00	1.00

\$58,111.20 64,132.14 \$65,012.20

(a) Gammino Constr. Co.; (b) A. I. Saven; (c) Fred D. Miller.

PUBLIC WORKS

An Engineering and Construction Journal

City

County

State

VOL. 62

JULY, 1931

NO. 7

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What Makes An Engineer?

In the *Bulletin* of the Western Society of Engineers not long ago were discussed briefly the qualifications essential for success in professional life. These are given in order of importance, as follows:

1. Character
2. Judgment
3. Efficiency
4. Understanding of men
5. Knowledge of life
6. Technical ability

These qualifications are worth a good deal of consideration by all engineers. We hope, especially, that the many young men just now seeking their first jobs as full-fledged engineers, after four years at college, will ponder these well.

At the Water Works Convention

It was a real pleasure to attend that Pittsburgh convention of the AWWA. Almost like a reunion of some of the more or less old-timers, with Jack Hinman, Prof. Babbitt, Clinton Decker, Ed Clark, C. A. Holmquist, Earl Devendorf, Glaze, Moses, Dugan, Prof. Boyce, Arthur Miller, Major Daniels, and a score of others dropping in on us, to the detriment of our attendance at the technical sessions, but to our great enjoyment. We hope to meet many of them again at the dinner of the Order of the Boar, at Carlisle July 13.

And Maine Was Pleasant, Too

And the following week, in the midst of the hot weather in New York, we exercised item 2, listed above, and enjoyed a week in the very pleasant company of Mr. A. J. Wiggan and other members of the Maine Highway Commission, learning about how to put a better surface treatment on roads. The information we secured will be passed on to our readers in the August issue.

Sniping in N. C.

Word comes up from North Carolina that H. E. Miller, for the past dozen years director of the Bureau of Engineering and Inspection of the State Board of Health, is about to be "released" as a result of the organization of the new Bureau of Sanitation. It will be a sorry day for health work in North Carolina. Mr. Miller, to our own personal knowledge, during the years of his incumbency, has worked marvels in improving health conditions. Probably the two outstanding results of his work are the carrying out of the provisions of the state-wide sanitary toilet law, and his improvement of water supplies.

Still, if the state health work is going to be run on partisan and political lines, a man of Mr. Miller's ability would be distinctly out of place there. But we certainly hope that North Carolina finds out soon that you can't mix health work with prejudice and politics very long and get away with it. Lots of other places have tried it and the result is always the same. The people suffer.

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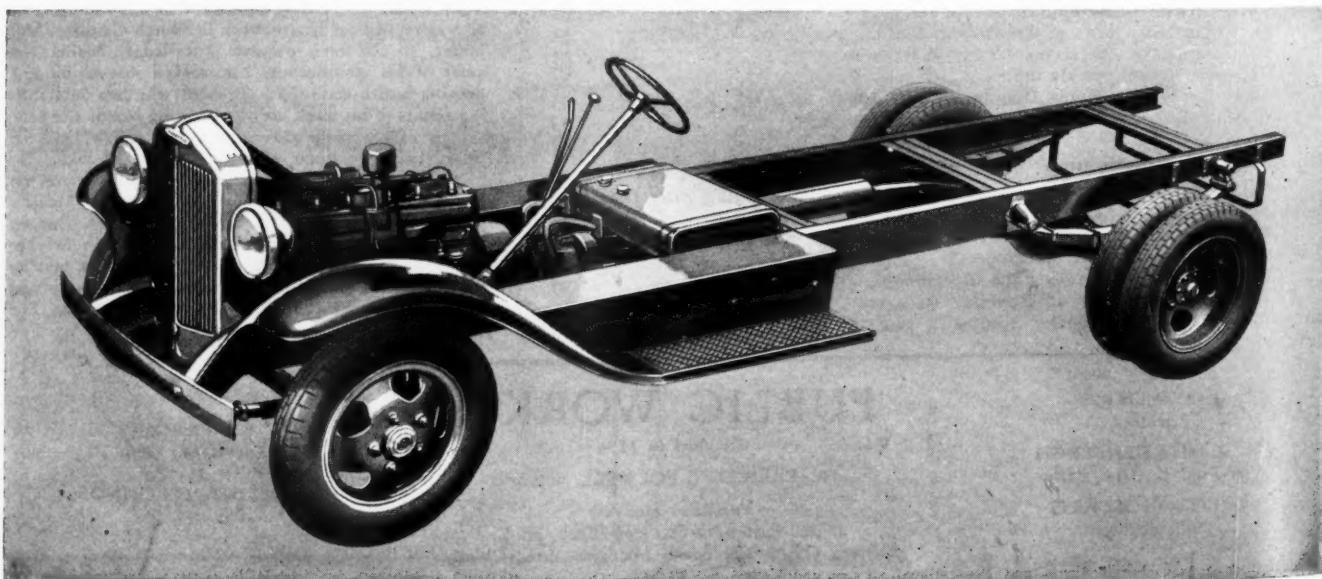
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PUBLIC WORKS

CITY

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AN ENGINEERING AND CONSTRUCTION MONTHLY

Vol. 62

July, 1931

No. 7



General view of night soil activated sludge plant. Left, settling and regulation tanks; at back, digester with supernatant liquid take-offs.

Activated Sludge Treatment of Night Soil in Japan¹

By
Willem Rudolfs²
and
S. Nishihara³

THE problem of proper sanitary disposal of night soil is of considerable importance in Japanese cities. Plumbing fixtures allowing for water carriage of excreta are limited to the larger buildings and private homes of the well-to-do citizens. During the last several years the Nishihara Engineering Company of Japan has been making extensive studies concerning the best means of sanitary disposal of night soil, with the result that the first installation of its kind was built at Kyoto in 1928 and began to operate at the beginning of 1929.

The plant at Kyoto consists of (A) a so-called Biolysis tank, which in effect is somewhat of a modified two-story settling tank; (B) a water level fluctuating chamber, for the purpose of scum prevention by fluctuating the water level through an automatic siphon; (C) a sump pit or wet well; (D) a machine room with blowers and pumps; (E) three aeration tanks; (F) final settling tank; (G) disinfecter with (H) a contact tank; (I) separate sludge digestion tank and (J) a series of sludge beds. The general

layout is shown herewith, and also a view of the installation.

The excreta of a population of 40,000 people are collected from the houses and transported to the treatment works by motor trucks and wagons. The volume amounts to 9,500 gallons a day. The trucks and wagons back up to the two-story tank and contents dumped. Here the material is diluted about 10 times with water so that the tank serves as a diluting, equalizing and temporary storage tank. The diluted liquid is pumped at an even flow to the aeration units, where again water is added, corresponding to about two and one-half times the inflow, so that the original excreta are diluted about 38 times before aeration. However, only a part of the solids reach the aeration units, since the heavy material is settled out in the two-story tank.

The aeration units are in effect designed to take care of the liquid portion of the collected material. To the aeration tanks 20 per cent activated sludge is returned. The results obtained from the aeration

Table I. Results After One Year's Operation

	Settling tank ppm.	Aeration tank No. 1 ppm.	Aeration tank No. 2 ppm.	Aeration tank No. 3 ppm.	Final settling ppm.	Effluent ppm.	Reduc- tion %
Free ammonia	15.0	9.1	15.0	9.0	6.0	6.0	60
Albuminoid ammonia	39.0	12.0	9.0	6.0	12.5	12.5	68
Nitrites as N	0.0	0.0	1.00	2.00	2.30	2.00	—
Nitrates as N	0.0	0.0	0.66	2.00	1.53	1.20	—
Oxygen consumed (4 hrs.)	12.25	0.96	0.96	1.09	0.43	0.66	95
Total bacteria*	208	2	2	22	0.5	0.2	99.9
B. coli* (Endo agar)	240	4	204	40	1.4	1	99.6

*Total bacteria and B. coli in thousands per c.c.

units and final settling tank, and the character of the effluent after partial chlorination are shown in table I. These results are representative after one year's operation.

The sludge from the two-story settling tank and the excess activated sludge from the final settling are pumped to the digestor. The digestor is of a unique construction, since it is divided into an upper and a lower section. The upper section receives the activated sludge, which is held there temporarily for concentration. The supernatant liquid is decanted and discharged directly onto the drying beds. The lower section receives the pre-settled or raw sludge and serves as the actual digestion tank. An arrangement is present whereby the activated sludge is mixed with the digesting sludge to accelerate the digestion processes.

The sludge obtained from the primary settling tank is rather concentrated and the decanted surplus activated sludge, although of an unusual density, naturally produces a less thick final sludge when mixed together. Results on the fertilizing values and moisture content of the dried sludges are given in table 2.

It is of interest that the fertilizing value of the

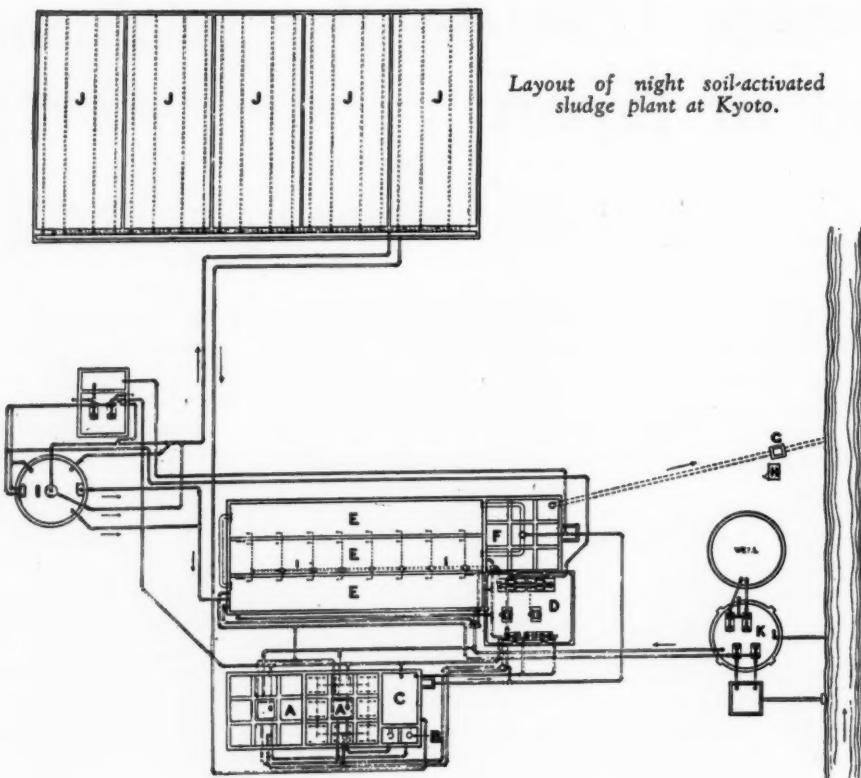
activated sludge is materially greater than of the pre-settled raw sludge. The fertilizing ingredients of the mixture of raw and activated sludge are approximately similar to the average of a number of widely scattered digested sludges obtained from sewage disposal plants in the United States. The nitrogen content of the activated sludge obtained at Kyoto is considerably less than of the sludge obtained in Milwaukee, Wisconsin, where the sewage contains considerable amounts of trade wastes. The diet of the people in Kyoto is naturally reflected in the an-

Table II. Fertilizing Values and Moisture Content of Sludges

	Total nitrogen	Phosphoric acid	Potassium	Moisture
Activated sludge ..	3.80%	4.39%	0.69%	6.82%
Raw sludge	1.89%	1.64%	0.45%	17.63%
Pre-settled and activated sludge mixture .	2.85%	2.68%	0.62%	7.84%

alyses of sludges. The moisture content of the settled and decanted activated sludge is low, with the result that considerably less digestion capacity is required than if the surplus activated was mixed with the raw sludge without previous concentration.

At present a very similar plant is being designed for excreta disposal of the city of Tokyo. The plant will also include hot air drying of the sludge, sludge storage houses and a fine screenings incinerator. The daily quantity to be treated is 47,500 gallons from a population of 200,000. The total volume of diluted excreta to be handled is about 1,800,000 gallons daily. The whole plant will be operated continuously with equal inflow by means of a receiving and regulating tank. The plant will be located on a small deserted island where insufficient room is available for drying beds, and sludge will be dried through a hot air heating plant which obtains its heat from the gas produced by the digestion of the sludge. The excreta will be brought to the island by boats.



¹ Journal Series New Jersey Agricultural Experiment Station, New Brunswick, N. J., Dept. Sewage Research.

² Chief, Dept. Sewage Research.

³ President, Nishihara Engineering Co.



Austin-Western graders mixing and turning bituminous material on a road in Arizona

Surface Treatment Methods

As Reported to Us by County Highway Engineers

THIRTY miles of dirt and macadam roads were oiled last year by Sebastian County, Ark., to a width of 18 feet, using a 10-ton roller, 3-ton trucks, a 700-gallon oil wagon, a 10-ton Caterpillar, a 12-ft and a 10-ft. blade grader and a No. 15 motor patrol.—*Joe Hardin, Road Commissioner.*

Iroquois County, Ill., oiled 100 miles of earth roads 10 feet wide, at a cost of \$200 per mile.—*Benj. Jordan, Superintendent of Highways.*

In building 1½ miles of oil-mixed-in-place road, Morgan County, Ill., employed the following methods: Earth subgrade was oiled with ½ gallon per square yard; 3 inches of gravel, 16 feet wide, was spread, oil mixed in gravel with distributor, disc pulverizer and tractor; maintained under traffic with multiple blade drag 30 feet long. Asphaltic road oil was used, with gravel and sand aggregate. The cost was \$1,803.50 per mile.—*M. J. Benscoter, County Superintendent of Highways.*

Sangamon County, Ill., reports oiling 300 miles of earth roads last year at a cost of \$150 per mile.—*T. L. Flatt, County Highway Superintendent.*

Lawrence County, Ind., surfaced 300 miles of roads with crushed stone, 1½-inch down, at a cost of \$250 per mile.—*W. H. Reed, Highway Superintendent.*

"Shape road and shoulders. New material in places where needed. Apply asphalt, then chips, then second application of asphalt." This the method that Will County, Ill., employed on a mile of gravel surface treatment work, 18 feet wide. The cost was \$7,800. Standard cut-back was used, with crushed stone from 1 inch down. Equipment used included

motor patrol grader and a home made spreader.—*Will H. Smith, County Highway Superintendent.*

Fifteen miles of water bound macadam were treated in Warrick County, Ind., to a width of 16-18 feet, with cut-back asphalt and crushed stone, 2½-1½ and 1-0, at a cost ranging from \$900 to \$1600 per mile. Equipment used included trucks, oil distributors, bladers, roller, maintainer, drag and brooms. The process was as follows: Thoroughly brush and clean old base, scarify and repair base where necessary, prime with light oil, spread stone to required depth, apply a coat of bitumen, mix, spread, drag, treat again, add stone, etc.—*Bourke C. Samples, County Engineer.*

White County, Ind., treated 5 miles of gravel and limestone road, 18 feet wide, with Mexican Asphalt, using limestone and gravel, ¼ to 1½ inches.—*Claude Scott, Auditor.*

Mixed-in-place surface treatment was applied on 1½ miles of gravel road in Kossuth County, Iowa, using road oil and gravel. The average cost for a 20-foot surface was \$1800 per mile.—*H. M. Smith, County Engineer.*

Clay County, Kans., constructed half a mile of oil-gravel, using No. 60 road oil applied to a sand gravel surface having 8% passing 100-mesh at 180°F. Disked, bladed, and rolled. Cost \$2015 for the half mile strip.—*Maloy Quinn, County Engineer.*

Tar and asphalt binder and limestone were used in surfacing 10 miles of 12-foot roadway in Kenton County, Kentucky. The cost per mile was \$4500.—*H. G. Meiners, Road Engineer.*

Caddo Parish, La., has continued its fine work, surfacing last year 38.57 miles of gravel and macadam with 250 to 300 penetration binder and 1-inch and smaller gravel. The average cost per mile has been \$1,632. The equipment used included one Kinney and one White distributor, small rollers and mechanical sweepers. The process is as follows: Sweep very clean; apply total of 0.63 gallon in two coats, cover from piles on roadside by shovels, with sweepers to help distribute the cover material evenly. Roll.—*J. T. Bullen, Parish Engineer.*

The method used in Cass County, Mich., is as follows: Prime coat gravel with $\frac{1}{3}$ gallon cutback per square yard after sweeping and smoothing surface. Then place $2\frac{1}{4}$ inches of stone (40% crushed) and apply $\frac{3}{4}$ of a gallon asphalt per square yard; mix with a stiff blade, then apply another $\frac{3}{4}$ gallon, mix, blade and roll. Then place seal coat, after two days, of $\frac{1}{4}$ gallon and cover with 25 pounds of pebbles per square yard.—*D. H. Miles, Engineer-Manager.*

Huron County, Mich., uses the regular tar retread, with Tarvia, and last year placed 3 miles on water bound macadam at a cost of \$3,000 per mile. The width was 16 feet.—*L. L. Bateman, County Engineer.*

In Kalamazoo County, Mich., 56.5 miles of gravel were resurfaced with asphalt and $\frac{1}{8}$ to $\frac{3}{4}$ -inch pebbles at a cost per mile of \$1,765. The pebbles were smoothed to an even thickness and loose gravel was placed on top, to a width of 20 feet and a depth of $2\frac{1}{2}$ inches. On this, $\frac{1}{2}$ gallon per square yard of asphalt was applied, and the surface mixed; another application of $\frac{1}{2}$ gallon was then given, and the whole mixed again. Then rolled with a 10-ton roller. Three or four weeks later, a squeegee coat of Texaco special macadam binder of 0.4 gal. was applied and covered with fine pebbles.—*Leo. J. Wykkel, County Engineer.*

Tarmac and cutback asphalt were used in treating $1\frac{1}{2}$ miles of gravel road in St. Joseph County, Mich. The width was 18 to 20 feet; the cost was \$3,500 per mile. A prime coat of $\frac{1}{4}$ gallon was followed by the application of 110 pounds of $\frac{1}{4}$ to 1-inch lime-

stone per square yard. Two applications of $\frac{1}{4}$ gallon each were then made, and the road leveled and rolled, after which 15 pounds of pea gravel were applied; then another $\frac{1}{4}$ gallon of binder and another 15 pounds of gravel. Then it was rolled. The equipment used included an oil distributor, grader, Adams maintainer, roller, broom, trucks and tractor.—*C. P. Chester, County Engineer.*

Carlton County, Minn., treated 9 miles of gravel, 24 feet wide, with $\frac{1}{4}$ to $\frac{1}{2}$ gallon of road oil. The gravel on the surface of the road was bladed smooth, then oil was applied and a blade grader turned the gravel immediately behind the distributor, thus allowing traffic to use the road at once.—*N. C. Nickerson, County Highway Engineer.*

Twenty-five miles of gravel were treated with road oil in Hennepin County, Minn., at a cost of \$1,500 per mile, using an oil distributor and a power grader.—*W. E. Duckett, Highway Engineer.*

St. Louis County, Minn., used the Minnesota blotter method on 8 miles of 24-foot roads, employing tar and gravel. The cost was \$1,100 per mile.—*S. B. Shepard, County Highway Engineer.*

The blotter treatment is also employed in Washington County, Minn., which, last year, treated 2.5 miles with Tarvia at a cost of \$1,200 per mile.—*J. G. Merten, Highway Engineer.*

Fifty-four miles of bituminous macadam were treated with Tarvia A, using $\frac{3}{8}$ -inch stone or slag, in Hunterdon County, N. J. The width of the treated surface was 14 feet. The cost was \$1,100 per mile. An oil distributor, trucks and spreaders and a 10-ton roller were used on this work.—*W. E. Roberts, County Engineer.*

Mercer County, N. J., applied surface treatment to 44.52 miles of macadam last year, the treated surface being 12 to 18 feet wide. The cost was \$800 per mile. Tar, cold and hot application, and pebbles or $\frac{1}{2}$ -inch pea gravel were used. Using an oil distributor, stone spreader, trucks, rollers, etc., the process was as follows: The road was swept clean and

(Continued on page 48)



At left, bitumen applied, road ready to roll. Right, Seal coat being applied.
Photographs furnished by R. M. Cushing, Tucson, Ariz.



Interior and exterior views of new pumping station. Left to right are shown City Commissioners Jeremiah Donovan and Joseph J. Feaster, Mayor John J. Morrison, Commissioners Frank A. Connolly and George F. Baier.

Paying for a New Pumping Station Out of Savings

New Brunswick's New Station Will Permit Annual Savings of \$20,000 and Will Return Its Cost to the City in Three Years

By Ellis Irving Cronk

ATIMELY checkup on the city's pumping costs by the commissioners of New Brunswick, N. J., and the subsequent erection of a modern pumping station with electrically driven pumps have lowered pumping costs to a mark where the savings in three years' time will pay for the new plant.

For the past two years the cost of running the old steam plant has been mounting steadily, and an investigation showed that further operation was most uneconomical. The cost of repairs to boiler, engine and pump was very high, and the need for a new station became imperative.

The new plant has been in operation for about five months, and the results over that period bear out the original estimate made by Commissioner Frank A. Connolly, showing that the annual savings to the city will average about \$20,000 and will repay the cost of the pumping station within a three-year period.

Before deciding upon an electrical station the city had a definite understanding with the Public Service Corporation, the latter agreeing to supply two independent power lines to the station. One of these comes from New Brunswick's sub-station over a wooden pole line, a distance of two miles, while the other comes from the Piscataway sub-station over the line of the main transmission on steel towers. The Public Service is tied in with neighboring power companies so that the possibility of a failure of power source is very remote.

The Pumps

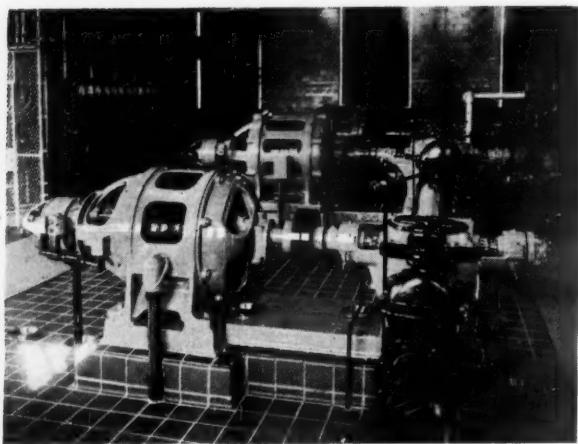
The pumps selected for the station were (1) an 8-inch centrifugal driven by a 200-horsepower syn-

chronous motor, with a capacity of 4 million gallons; (2) two 12-inch centrifugal pumps driven by 300-horsepower synchronous motors, with a capacity of 6 million gallons each. The pumps were furnished by the American Well Works and are equipped with Westinghouse motors. One of the 12-inch pumps has a 250-horsepower gasoline engine which can be coupled to the pump and operated in an emergency. The total capacity of the station is now 16 million gallons per day at the highest head.

The water is pumped through the two pumping mains 8,000 feet to the reservoir, against a static head of 123.5 feet. The friction on the lines was determined by pitot tube measurements of flow through the mains with corresponding pressures, and it was determined that the Hazen coefficient for the pipes was 73. The large amount of friction in the pipes makes the use of a centrifugal pump difficult for this service.

In the design of impellers for the pump due consideration had to be taken of the number of pumps in operation, for at times the working head will vary from 150 to 220 feet. The impellers of the pumps had to be designed to give the required amount of water at the highest head and yet give a reasonable efficiency when delivering water at a lower head; and so as not to overload the motors at any time. The 12-inch pumps at the station show an efficiency of 77% at 150 feet head, 84.5% at 200 feet head and 82% at 220 feet head. This will insure a reasonable efficiency under all working conditions.

The motors which have been in use at the filtration plant for the past thirteen years are slip ring motors. Those at the new station are of the synchronous type.



Arrangement of Pumps and Motors

The Public Service Corporation makes no discount for the use of synchronous motors, as many power companies do, but it is hoped that in the future there may be some allowance for their use.

Electrical Equipment

The motors are operated by remote control from an 8 panel switchboard. The panels are arranged as follows: No. 1, the power company's meter panel; Nos. 2 and 3, the incoming line control; Nos. 4, 5 and 6, the motor controls; No. 7, the transformer bank; and No. 8, a low voltage panel, for lighting and small motors.

There are two three-phase incoming lines from two different sources. The breakers are single throw oil switches with trip coil attachments. The breakers are protected by disconnects both on the line side and on the station side. These circuit breakers are manually operated. The motors are operated by remote push button control, the starting being by the reactance method. There are two sets of motor-operated automatic oil switches for each pump motor.

The current is thrown on the exciter through a starting circuit breaker and through a starting reactor. When synchronous speed is reached the current is automatically thrown on the running circuit breaker which cuts out the starting circuit and applies full voltage to the motor.

The motor operated mechanism which controls the oil circuit breakers is run on 220-volt current through a rectox outfit and time relays, the low voltage mechanism being operated through three 5-Kva 4150-volt to 220-volt transformers. The lighting panel is controlled by a separate 1½-Kva 220/110-volt balance transformer.

There are a number of small motors about the plant and these are operated from the lighting panel. All of the motors are controlled from a buss through a 40/1 fused potential transformer.

The Pumping Station

The station itself is attractive in appearance and modern in every detail of its construction. The exterior is of Colonial brick with Limestone trim, while the roof is of rough variegated slate. The interior walls are lined with buff-colored wall tile and the floor is of dark red quarry tile laid in 6-inch squares with black mortar.

The building, which is 40x48 feet, is provided with a boiler room and is heated with an oil burner which is connected with two overhead fan heating units. The main suction and discharge pipes are located in the basement, where may also be found the reactors and transformers.

The contracts for the work were as follows:

Pumps and Electrical Equipment	\$24,000
Building	21,730
Plumbing and Heating	3,000
Oil Burner	945
Electric Lighting	865

The above figures do not include the cost of the main suction and discharge pipings, as this work was done by the city force.

The suction pipe is a 30-inch cast iron pipe running from the pond to the station. The floor of the station is one foot below pond level, so the normal suction is less than two feet. The discharge is a 24-inch cast iron pipe branching into two 18-inch pipes. These pipes were tapped into the two 20-inch mains under pressure. In making these cuts a good opportunity was afforded to see the condition of the old pipes. There was very little corrosion, but there was a solid growth of matter one inch in thickness adhering to the pipe. This was mostly fresh water sponge and accounts for the high friction in the pipe. There is a 24x24 inch venturi pipe in the discharge connected with a register in the pumping station.

Albany's New Water Supply Nears Completion

The new water supply of Albany, N. Y., which is derived from Hannacroix creek, is rapidly nearing completion. Water from the impounding reservoir at Alcove has been sent through the pipe line as far as the new filtration plant at Feura Bush, where preliminary tests are being made. The cost of the present project is about \$6,000,000.

The impounding reservoir at Alcove has a usable capacity of 12,000,000,000 gallons which is sufficient to supply the city for 600 days or nearly two years. Rules and regulations have been enacted by the State Commissioner of Health for the protection of this water supply from contamination.

The city is authorized by law to sell water to any municipality within the county in which any of the reservoirs are located or through which any pipe line is constructed, or to any corporation or individual outside of the city. Some communities are reported to have made overtures already for the use of this supply.

As soon as the new supply is completely available the use of Hudson river water will be abandoned.

Unusual Use of Snow Plows

An unusual use of snow plows was reported by the Clearfield Division of the Pennsylvania State Highway Department, this spring. Numerous falls of small rocks were noted on sections of highway passing through cuts. Caretakers were unable to keep the highway clear of these for a time and enlisted the aid of snow plows, which pushed the rocks to the roadside.

Expert Blasting Necessary on This Highway Job in Pennsylvania



Upper left—The ledge through which the road was constructed. Telegraph poles show line of old road. Upper right—The first cut and equipment used. Lower left—Shovel working in the second cut. The old road can be seen at the left background. Lower right—Fill at the end of the road made with rock removed from the cut.

PRECISE blasting and careful planning were used by the Swanger Co., of Lancaster, Pa., in removing 70,000 cubic yards of rock from a bluff 100 feet above and almost overhanging the four-track main line of the Pennsylvania railroad over which 280 trains run each day between Philadelphia and Pittsburgh. The rock was a very hard, unaltered sandstone, pitching toward the railroad, making it necessary that special care be taken to avoid slides onto the railroad property. In spite of these difficulties, not a stone was thrown onto the

railroad nor was the railroad traffic held up for a moment by any occurrence in connection with the work of construction.

This work was done in connection with eliminating some very difficult grades and bad curves on a 1½-mile stretch of route 5, one mile east of Duncannon, Pa., along the west bank of the Susquehanna river. The general contract for this stretch of construction was let by the Pennsylvania Highway Department to the J. H. Wickersham Construction Co., of Lancaster,

(Continued on page 74)

Time Losses Are Costly	
Faulty truck operation produced these time losses for a mixer on one construction job:	
Day	Minutes Lost
1	34 Minutes
2	29 "
3	61 "
4	36 "
5	87 "
6	78 "
7	112 "
8	117 "
9	138 "
10	124 "
Total.....	
\$571.20	

Operating Motor Trucks Profitably in Contracting

The third in a series of articles on saving money on motor truck operation, based on a nationwide survey made by the General Motors Truck Co. and presented in a slightly condensed form with their permission

PRECEDING portions of this report have stressed the practical means by which the costly waste of truck time, on contract work, can be reduced. It should be borne in mind, however, that the primary purpose of a contractor's truck operation is to keep the job moving. Efforts to save time for the trucks should not interfere with the steady progress of the job. On the contrary, the job comes first. The cost of delays for men and machinery, on the job, may far outweigh the cost of idle truck time.

This is particularly true when the contractor comes to consider the question of providing sufficient truck capacity for the requirements of the work. In all such operations as wrecking, excavating, road building, and heavy materials supply, the contractor or sub-contractor must set up a fleet that is fully adequate for peak demands. Failure to meet this common-sense requirement will involve either one or the other of two types of loss:

FIGURING THE TRUCK SUPPLY

A one-yard mixer, on a standard mix, has a capacity of 40 yards an hour.

With the commonly used 2-batch trucks, that means 20 loads per hour must be delivered to the mixer.

Suppose the distance between the source of supply and the mixer is $\frac{1}{4}$ of a mile. A truck traveling at average speed will make that distance in 4 minutes. The required truck supply is estimated as follows:

Loading at batcher.....	4 min.
Taking on cement.....	30 sec.
Trip out.....	4 min.
Unloading 1st batch.....	30 sec.
Waiting for mix.....	1 min. 30 sec.
Unloading 2nd batch.....	30 sec.
Trip back	4 min.
Total	15 min.

That means each truck can make 4 trips per hour. 20 divided by 4, therefore, gives 5, the number of trucks required for actual operation, plus 1 as a safety factor in case of breakdown.

Six trucks, therefore, is exactly the right number. Any less means serious losses. And more means waste.

1 The waste of idle truck time, resulting from providing excess truck supply.

2 The waste of idle time on the job, resulting from lack of sufficient truck supply.

Faced with the choice between these two evils, the average contractor will usually prefer to take a loss on the truck operation, rather than to delay the actual progress of the job. And, indeed, he may be right in making this choice, for his greatest need is to make certain that the job progresses steadily and without interruption.

In some cases, too, bonuses offered for work finished on time, or ahead of time, may become inducements worth considering, and may justify the contractor in over-servicing the job, even to the extent of having several more trucks than the job actually requires. But in such instances, the provision of excess truck capacity is simply a form of insurance, which should be figured as a part of the legitimate cost of the work. On the average job, where there is no bonus inducement, more truck supply than is really needed is only a decided waste.

Haphazard Methods Waste Money

One common source of loss, in attempting to set up the correct truck supply for a job, is the use of haphazard, "cut-and-try" methods. On one job observed during the survey for this report, for instance, the number of trucks used in hauling materials to the mixer was as follows: First day—22; second day—32; third day—27. In other words, the mixer was under-supplied, then over-supplied. And even the truck supply on the third day was incorrect, for there were still five or six trucks constantly waiting in line at the mixer. The total cost of this experimentation ran well past \$400, in the first three days alone.

Fitting Fleet Capacity to the Job's Needs

The desirability of providing a total truck supply that will fit the job, without waste in either the truck operation or in the handling of the work on the job,

does not alter the fact that there must also be full provision for variable factors—breakdowns on the road, delays at one point or another, and so on. In normal practice, the contractor must accept, as a part of the day's work, the need of meeting all such contingencies.

For that reason, the calculation of the correct truck supply for the job usually involves two steps:

- 1 Figuring the exact truck supply required by the job.
- 2 Estimating the excess truck supply needed for contingencies.

The first of these two steps can usually be taken with considerable certainty. The second, of course, demands judgment and experience.

Estimating Daily Capacity Needs

In any event, the first step to be taken is to calculate as exactly as possible the total *daily* tonnage or yardage to be hauled. Often this can be done with a fairly high degree of accuracy.

Wrecking.—The speed of the crew on the job determines how fast the trucks can be fed. After dismantling fittings and removing the salvaged materials, it is fairly easy to estimate the volume of brick, mortar and rubbish to be hauled away each day.

Excavating.—The cycle of the shovel or clam sets the pace for the truck supply. The shovel must not be kept waiting. If it has a capacity of 108 yards an hour, that means that a truck supply capable of moving 108 yards an hour is required—with a reasonable deduction for time allowed for moving the shovel, if such movements must be made during normal working hours when the trucks are in service.

Road Work.—After the subgrade has been prepared, the truck supply must be geared to the mixing cycle of the mixer and to the mixer's total daily output. To keep a 1½-yard mixer busy, with an hourly capacity of 60 yards, the truck must deliver a minimum of 60 yards an hour to the mixer.

Building Construction.—The variety of demands on truck capacity, with many operations being carried on in a limited space, may make it difficult to estimate total capacity needs very exactly. Normally, however, the requirements of each day's deliveries to the job can be estimated exactly enough for practical purposes.

Once the daily capacity of the job itself has been determined, the next factor to consider is that of *trip time* for the trucks. How this can be done is shown in the typical example herewith.

Determining the Number of Trucks Required

When the capacity of the individual trucks to be used is already known, as in the case of a contractor operating his own equipment or requiring sub-contractors to use a certain size of truck, the time for each trip, including all necessary operations, will determine how many trips can be made in a working day. Thus the practical formula for determining the number of trucks is as follows:

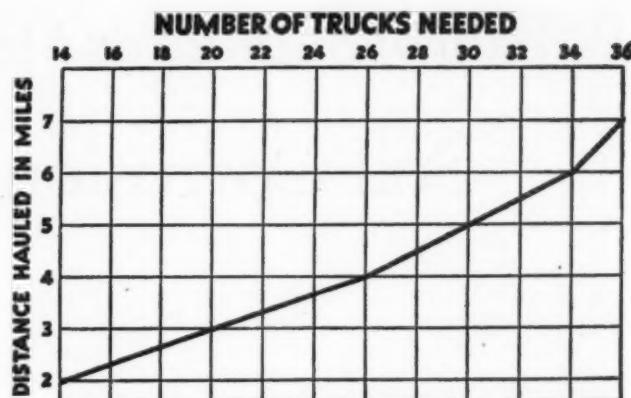
D

$\frac{D}{T \times C}$ = No. of trucks needed.

T = Daily tonnage or yardage.

T = Trips per day per truck.

C = Capacity of individual truck.



A typical forecast of truck supply on a road building job.

In this simple formula, the one factor that requires most careful calculation is that of the number of trips each truck can make each day. This, in turn, depends upon accurate figuring of the total time for each round trip, which must include a full normal allowance for every operation in the trip. The example shown herewith illustrates the practical application of this method in figuring the number of trucks required to supply a one-yard mixer on a typical road job. Similar methods, of course, can be applied on any other type of work involving steady hauling.

When Distance Is Variable

On excavating work, where the distance from the job to the dump remains constant, one calculation of the number of trucks required should be sufficient. On road work, however, where the distance between the materials and the mixer either increases or decreases each day, with the mixers pouring about 1300 to 1500 feet a day, the total truck supply will necessarily vary in proportion to the length of the haul. For that reason, on such work, the one safe plan is to figure the varying demands *in advance*, for the changing distances that the trucks will have to travel. The chart at the head of this column shows how this forecast of truck requirements was set up on one typical road job.

Such forecasting enables the contractor to set up a definite, practical plan for his truck supply.

(Continued on page 48)

A TYPICAL COMPARISON OF COST INDEX FIGURES

THE JOB: Hauling reinforcing steel from a railroad siding to a construction job 6 miles distant. The two trucks under consideration are a 5-ton truck and a 3-ton truck, on which operating costs are 1/10 less than on the larger truck.

TRUCK A: Capacity, 5 tons. Average speed, 18 miles per hour. Taking the operating cost of the truck as 100%, the cost index works out as follows:

$$\frac{6 \times 100}{5 \times 18} = 6.6 \text{ Cost Index Figure}$$

TRUCK B: Capacity, 3 tons. Average speed, 22 miles per hour. Operating cost, 90% of operating cost of Truck A. The cost index works out as follows:

$$\frac{6 \times 90}{3 \times 22} = 8.2, \text{ Cost Index Figure}$$

COMPARISON: Difference in cost index figures...1.6
Taking cost index of Truck A as basis:

$$1.6 + 8.2 = 19.5\%$$

That is, cost of hauling on Truck B will be 19.5% greater than cost of hauling on Truck A.

Bureau of Standards Makes Progress Report on Soil Corrosion Tests on Pipe

A REVIEW of the soil corrosion studies on which the Bureau of Standards has been engaged since 1922, indicates that valuable information will be available after the completion of tests on the proper materials and methods of pipe installation for various soils. While the studies reveal the fact that many soils have little or no corrosive effect, there are certain soils where these effects are marked.

Another interesting fact disclosed by the research work up to this time is that the rate of corrosion changes materially, becoming slower, as the pipe becomes older. Furthermore, not only the rate of corrosion but the change of rate varies with different soils. For this reason the Bureau of Standards has issued a warning that no final conclusions as to the relative merits of materials should be drawn from these studies until they are completed. This will not be until at least 1935 and probably later because of the fact that the scope of the investigation has been widened and many specimens have not been buried long enough.

One of the important facts that has been established is that nothing which has so far been discovered can be taken as having in any way proved that indefinite life can be secured by the use of coatings.

It will be recalled that these tests were originally scheduled to run over a period of 13 years, from 1922 to 1935. In 1922 many different kinds of pipes, coated and uncoated, were buried in various types of soils in selected parts of the country and it was planned to remove specimens of each for measurement and observation every two years. Now that nine years have elapsed it has been shown to be advisable to extend this period in order to secure the additional data from more specimens which have been added and

to also secure data on soils that were not included in the original plans.

The initial steps in this investigation took place in 1911 when the Bureau of Standards, as a member of the American Committee on Electrolysis, began to study the effects of stray electric currents from street railway lines. It was discovered by this committee that the rates of corrosion varied so greatly in different types of soils that it was suspected that the soils themselves were responsible for some of the corrosion. This suspicion has since been justified, and the water and gas industries as well as pipe and other manufacturers are naturally interested to a great degree in the results of the studies.

The Bureau of Standards is plotting the results of the tests in the form of curves which show the average rate of corrosion in each type of soil for each year, as determined by a measurement of the depth of corrosion. The materials have all been buried in or near cities at such depths as conform to the practice of the local utility companies. The earth removed from the trench bottom was placed in and around the specimens in order to secure uniform conditions for all specimens in the trench. To the original uncoated specimens were added various types of metallic, non-metallic and bituminous coatings, many of the latter specimens being buried during the years of 1924 and 1926.

Details of the scope of the tests as originally planned and a complete discussion of the soils involved are contained in Technologic Papers of the Bureau of Standards, No. 268, and Soil Corrosion Studies, Research Paper No. 95. These papers are available at the government printing office, Superintendent of Documents, Washington, D. C.

Maintenance Work in Michigan

This picture shows an Oakland County, Michigan, maintenance crew filling and sanding joints on a concrete highway.

The sanding barrow they are using was designed by the highway department. The kettle supplying tar is a 1927 Model Littleford Bros. No. 78 Wood Burning Trail-O-Heater, capacity, 300 gallons.

The photograph was sent in by E. J. Vaughan, Maintenance Engineer, and was furnished us by Littleford Bros.





Sewage disposal plant of Geo. A. Hormel & Co., Austin, Minn.

Raw sewage enters the primary clarifier (at extreme right), where large particles of organic matter are removed and majority of grease skimmed off. Effluent passes to mixing tanks (beneath building), where chlorine is applied; then to secondary clarifier (in foreground), where final settling occurs. The sludge is removed by a Dorr clarifier into narrow channels at the right of the basin, and the effluent passes through a channel at the left into the river.

A New Treatment for Meat Packing Wastes

By W. P. Fullen
and
E. N. Anderson

Chemical engineer and mechanical engineer respectively, with Geo. A. Hormel & Co.

Treatment with chlorine and double sedimentation gives good effluent and sludge with high fertilizing value

ASURVEY of this field will reveal that standard methods of sewage treatment are inadequate for packinghouse wastes.

Practically all of them depend upon biological activities which are more or less interfered with in packinghouse wastes by the high salt and fat content. These biological processes have been attempted by various packers, either by treating their sewage alone or by mixing it with domestic wastes.

Unless the dilution in the latter case has been very great, the biological treatment has not met with success, and even under the most favorable conditions a great deal of difficulty has been encountered.

The first installations involving septicization in septic or Imhoff tanks have, in most cases, been discarded. The consensus of opinion at the present time indicates that the ordinary types of sprinkling filters will not function with packinghouse wastes.

Until quite recently it was felt that the most promising method was the activated sludge, but most of these installations also have been discarded as inadequate.

The only biological treatment which, at the present time, holds any promise of success is the compound filtration employed at the Jacob E. Decker &

Sons Co. packing plant at Mason City, Iowa. After investigating this plant and its method we felt that, although the operation is successful to a certain degree, this process left much to be desired.

One of the outstanding objections to all of the present methods is, of course, the cost of operation.

In practically all instances where plants are treating in the neighborhood of a million gallons per day of packinghouse sewage it costs them \$100 to \$200 per million gallons to treat it. It is felt that this is an excessive burden on the industry involved, and that new methods of treatment must be found that can be operated at a lower net cost.

Investigations conducted at the plant of Geo. A. Hormel & Company have been directed towards finding ways and means of recovering the protein from the sewage, so that its value can be used to defray operating expenses.

In the biological method of treatment attempts are made to decompose the organic matter as completely as possible, so that it can undergo further decomposition when the sewage is dumped into lakes or streams. This necessarily means that in any method of biological treatment the value of the organic material present is lost.

In order to be able to recover nitrogenous material so that its value can be used to defray operating expenses, it is necessary to remove it in a more or less unchanged condition. To make such a method successful it would, therefore, be necessary to eliminate, as far as possible, all biological activity.

This is accomplished, to a certain extent, in all methods of chemical precipitation. But these have not met with general success because of the high cost of chemicals and because the nitrogenous matter in the sludge is so highly diluted with the chemicals used that the cost of handling the sludge becomes excessive.

This, combined with the fact that the ordinary chemical precipitation removes only suspended matter, and not the dissolved solids, makes all these methods inadequate. The effluents produced in such treatment plants, even though they may be clear, generally contain so much putrescible material that further treatment is necessary.

Any method of chemical precipitation, to be successful, must therefore not only remove suspended organic matter, but must also remove the dissolved packinghouse sewage, which contains on the average in the neighborhood of 100 parts per million of nitrogen in the form of organic matter.

If this nitrogenous material can be removed, *it should have sufficient market value to reduce considerably the cost involved* in the precipitation, providing the ordinary objections to general precipitation can be overcome.

Observations made in the laboratories of Geo. A. Hormel & Company indicate that chlorine, in suitable quantities, can be used in the precipitation of effluent efficiently and economically.

Preliminary investigation indicated that there was sufficient volume of sewage at this plant to allow recovery of the protein at little or no net cost. On the basis of these findings a plant was installed during the summer of 1930.

In this newly-constructed plant the raw sewage coming from the packing plant first enters a small Dorr clarifier, which is checked to a detention of approximately 20 minutes. During this short detention large particles of organic matter which settle later are removed. In addition, the majority of the grease comes to the surface and can be skimmed off.

The effluent from this Dorr clarifier is treated with chlorine, and after suitable agitation is run into a second clarifier, where the precipitation takes place.

Detention in the second clarifier is longer than in the first. From this second clarifier the sludge is removed to be de-watered, and then dried in the regular tankage drier.

The dried sludge has a protein value of from 40 to 50%, or an ammonia content of from 9.3 to 9.5%.

The sludge at first contains about 90% water. This water content is reduced to 75% very readily.

Plant sewage going through this treating plant does not include clear water from the plant. Condenser water is pumped directly and goes back to the river at the same point, thereby keeping all clear water out of the sewage disposal system. In general, however, all other plant water runs into the screens, where the bulky solids are removed before the chlorine treatment begins.

Salt water has been considered a handicap in treating sewage chemically. Curing brine is saved as far as possible in the Hormel plant—because there is actual value in reclaimed pickle—but there are washings from curing floors and occasional dumped vats which cause some volume of content in the sewage heavily impregnated with salt and sugar. Too much of this sort of effluent is not beneficial to any type of sewage disposal treatment, but it is handled without difficulty in the Hormel method.

All possible causes of sewage contamination are eliminated at the source as in any well-regulated plant. As much waste water as possible is trapped from the killing floors, saving greases and fats as close to the source as possible. What is not saved in that manner is run into agitated tanks, where the grease is allowed to separate and come to the top, where it is skimmed.

Every manufacturing room in the Hormel plant is carefully trapped in the interest of economy. These precautions make sewage treatment that much easier, as well as effecting savings in addition to those gained in the disposal plant recovery.

The plant at Austin has been in operation for a period of about five months, and during this time we have observed considerable improvement in the river.

There are two dams in the Cedar River, into which this sewage is disposed of, about two miles apart. The plant sewage in the past was discharged just below the upper dam. There exists naturally a large quiescent pool that has allowed sufficient settling of the organic matter in the sewage, which has naturally become very septic.

Previous to the installation of the new plant conditions in this river were rather serious. Odors were always prevalent. A large amount of sludge could be observed on the surface of the water at all times. The BOD of the water just below the discharge of the packinghouse sewer was in the neighborhood of 200 parts per million.

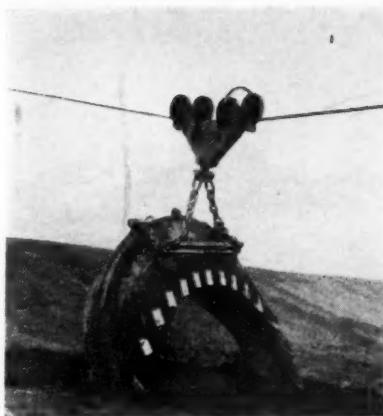
After the new plant had been in operation for a period of about two weeks odors completely disappeared. After the plant had been operating for about three months, no more floating sludge could be observed, and after four months operation the bottom of the river now can be seen for about half the distance between the two dams.

The BOD of the river below the point of discharge of the sewer has dropped from the former figure of 200 down to below 20. Improvements of the same nature have naturally been observed in the river below the lower dam. It is felt that the treatment the sewage now receives is sufficient to completely avoid any nuisance, and that next summer, when the sludge between the two dams has completely decomposed, even further improvements may be observed.

The early predictions regarding the cost of operation have been borne out.

At the present time approximately five tons of sludge are being removed from the sewage. This takes into consideration both the primary and secondary sludge. The chlorine consumption does not exceed 2,000 lbs. per day to remove this amount of sludge.

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Close up of a Sauerman 12 cubic yard bucket on end of return trip about to start digging tough material in East Bayou.

Construction Methods and Equipment on the New Madrid Floodway

THE New Madrid Floodway is being created by constructing a new levee approximately five miles back from the existing front line levee and extending from Birds Point, Mo., opposite Cairo, Ill., to New Madrid, Mo. This provides a secondary channel and incidentally a storage basin at periods of extreme floods in the Mississippi river. The primary purpose of this floodway is to reduce the stage of floods which go higher than 55 on the Cario gage (55 is 5ft. lower than the levee grade in that vicinity). To insure the operation of the floodway at this elevation, about eleven miles of the upper end of the floodway levee will be cut off to the equivalent of 55 ft. This means the cutting off of about 3 feet.

The general drainage of this country is north to south. The direction of the floodway levee is from northeast to southwest, so that the normal drainage flow is intercepted by the proposed construction. To take care of this intercepted drainage, a diversion ditch following closely in back of the floodway levee is being constructed. Thus the creation of the New Madrid floodway involves first, the construction of the floodway levee; second, the construction of a drainage ditch to take care of the intercepted drainage; third, the cutting off of the existing front line levee about 3 ft. to the equivalent of 55; and fourth, the acquirement of flowage rights over the land lying between the existing front line levee and the floodway levee. As an incident to the construction of the

ditch, it is necessary to construct a large number of bridges to carry existing roads across the ditch and in some cases, as a matter of economy in securing right of way, it is necessary to provide private crossings over the ditch.

The lower or south sixteen miles of the floodway levee is in the backwater area. Through this backwater section it was considered practical to construct the levee from the material obtained from the drainage ditch, leaving a berm between the levee and ditch varying in width from 100 to 500 feet. This is sound practice, because when the floodway will be in operation, backwater will have covered the country and filled the ditch so that the danger from sand boils or seepage will become negligible. Above this point, however, the ditch has been kept from 500 to 1000 feet back from the levee, and it was not, therefore, practical to use the material excavated from the ditch to construct the levee. Also the material excavated from the upper section of the ditch is approximately one-third only of the material required to construct the levee.

There are six contracts for levee construction, five of which are for approximately 2,000,000 yards each and one for approximately 1,000,000 yards. The upper two, totalling 4,000,000 yards, are constructed from riverside borrow pit. These are pieces 4-A and 4-B. The lower four, pieces 4-C, D, E, and F, are constructed from the material in the drainage borrow pit. For the drainage ditch construction, there



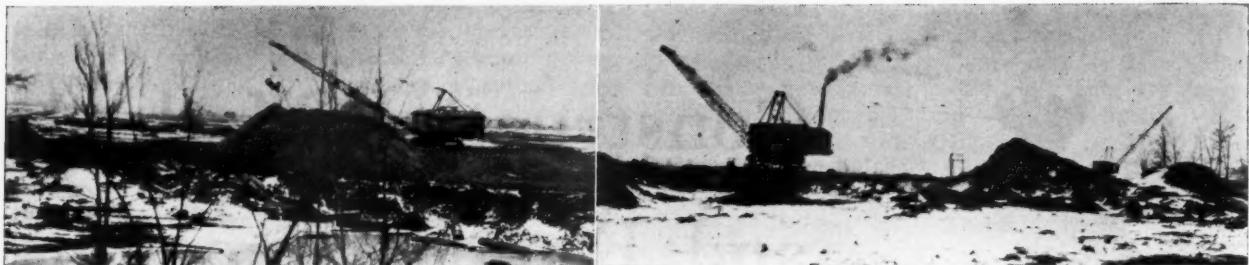
Tower machine placing materials in levee. 12 cu. yd. bucket. Clarke Bros. Construction Co.



The levee section and the head tower of the Bucyrus-Erie tower machine.



Bucket in pit, tail tower beyond. View from Bucyrus-Erie electric tower.



On the McCaughey job. At left a Page dragline and at the right a 6-yard Marion and a 1 1/4-yard Northwest.

is one excavation contract which includes minor structures. There is one bridge contract which covers bridges, roads and culverts in the riverside borrow pits, and one concrete structure contract which covers the three main concrete structures on this job.

Draglines on Contract 4-A.

Contract 4-A, which was awarded to J. J. McCaughey Co., involves 1,900,000 cubic yards, for which the contract price is 20 cents. Most of this work is being done by draglines. McCaughey is using on this job the following equipment: one Marion steam dragline with a 145-foot boom and a 6-yard bucket; one Page dragline with a 90-foot boom and a 3-yard bucket; and a Northwest dragline with a 60-foot boom and a 1 1/4 yard bucket.

The Page dragline is used to throw material from the rear of the borrow pit so that it can be reached by the Marion, which handles all the dirt going into the levee section. The Northwest dragline finishes up the levee section and also is used on other work, such as digging the muck ditch.

On this section of the levee (from Birds Point to Wyatt) a special crown is being placed on the levee so that the state highway, which is now located in the floodway, can be constructed on its top.

An Electric Tower Machine

The latest type of equipment—an electric tower machine—is in use on Contract No. 4-B, which is

being put up by Clarke Bros. Constr. Co. This contract involves 2,056,000 cubic yards of earth for which the contract price is 15.75 cents a yard.

Near the middle of his contract, at the town of Anniston, the contractor has constructed a power plant, from which power is carried by aluminum transmission lines to the tower machine. Power is furnished by a two-unit Diesel electric plant consisting of two Busch-Sulzer 400 h.p. units, direct connected to 270 kw, 4400 volt, 3 phase, 60-cycle generators. The power is used to drive the synchronous motor of the tower machine, which drives D. C. generators furnishing direct current at 400 volts to the machinery motors. Each Diesel generating unit is mounted complete on a cast iron sub-base; this allows easy removal to another location upon the completion of the contract.

The tower machine is a Bucyrus, with a head tower 120 feet high; the tail tower is propelled independently by a gasoline engine. Both a 10-yard semi-bottomless, and a 12-yard Sauerman bucket have been used. The latter was put in service about the middle of November especially to handle some tough material near the East Bayou.

Progress has been very satisfactory with this equipment. Cost for fuel and lubricating oil has ranged as little as one-half cent a yard.

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At right—Loading a 7-yard Western crawler wagon, drawn by a Caterpillar "60" with a Northwest gas shovel on the Yates job, McCaughey subcontract.



Left—A Bucyrus-Erie 6-yard dragline on the McCaughey subcontract of 4D. This machine is throwing in to the levee which is being shaped up by a Monighan 6-yard.

Trends in the Construction of Street Pavements 1925-1929

As determined by a study of street paving in representative American cities

“THE expansion of city street paving which characterized the ten years ended December 31, 1929, according to a survey of 201 representative cities made by the Bureau of Mines, reached its climax in 1927, with decreases reported for 1928 and 1929. The upward trend, followed by a decline, was general in cities of all sizes included in this study, but was most prominent in cities of 40,000 to 100,000 inhabitants and in the Northeastern, Southeastern and Southwestern States. In the North-Central States the trend of paving was downward from 1925 to 1929; in the Pacific and Rocky Mountain States it was generally upward.”

The above general statement is made in the introduction to the U. S. Bureau of Mines Information Circular 6,431, entitled “Street Paving in Representative American Cities, 1925-1929.” According to this circular: “No public agency has hitherto undertaken to compile statistics of city street paving. It is the purpose of this study to supply in part that lack and to furnish a statistical basis for estimating trends in the laying of street pavements in general and of asphaltic pavements in particular.”

The Bureau addressed inquiries to city engineers or other officials of 230 municipalities with popula-

tions exceeding 40,000 in 1928; or, in the case of states containing no cities of that size, to the largest city in the state. Sufficient data for the purpose of the inquiry were received from 201 cities in 46 states and the District of Columbia. This includes all cities of over 500,000 population; 96.7 of the population residing in cities of 250,000 to 500,000; 93 per cent of that in cities of 100,000 to 250,000; and 80.3 per cent of that in cities of 40,000 to 100,000. “The purpose of the survey was to obtain over a series of years comparable figures from a sufficient number of representative American cities to permit the study of trends or tendencies in city paving.”

In general, both new pavement and resurfacing are included and maintenance and repair excluded, because figures for the latter are not kept by many cities and would reveal little or nothing about tendencies if obtainable.

A general summary of the figures obtained is given in the circular as follows:

“Over the nation as a whole, bituminous types of paving continued to lead, furnishing two-thirds of the total street pavement laid in the 201 cities from 1925 to 1929. The actual yardage of bituminous pavement laid in these cities, however, was 3.8 per

Total Area of Street Pavement Laid in 201 Cities, 1925-1929
By Types of Paving. (In square yards.)

	1925	1926	1927	1928	1929
Sheet asphalt	18,776,011	19,489,373	21,404,872	19,135,125	17,932,095
Asphaltic concrete	9,845,142	12,188,700	9,759,280	9,729,686	8,228,577
Asphaltic macadam	1,346,935	1,502,708	1,369,836	1,719,319	2,586,820
Asphalt block	416,523	961,495	991,092	203,987	133,788
Natural rock asphalt	852,725	814,444	1,163,335	1,099,940	1,086,780
Other asphaltic types	1,800,582	1,519,812	1,615,689	1,295,470	1,699,876
Tar macadam	114,433	39,055	27,917	10,099	10,000
Total bituminous	33,152,351	36,515,587	36,332,021	33,193,626	31,677,936
Portland-cement concrete	9,050,054	11,407,851	15,908,957	15,889,144	13,777,081
Brick, block, and stone	5,084,180	5,615,322	5,703,273	4,412,155	3,413,019
Total	47,286,585	53,538,760	57,944,251	53,494,925	48,868,036
Geographic Districts					
Northeastern	26,711,257	28,740,042	32,379,220	29,711,606	27,288,789
Southeastern	4,727,107	5,696,882	5,956,072	3,714,401	3,621,420
Southwestern	4,036,221	4,427,700	4,942,712	4,509,577	4,609,738
North Central	3,853,858	3,471,029	3,574,668	2,792,326	2,755,630
Pacific-Rocky Mountain	7,958,142	11,203,107	11,091,579	12,766,815	10,592,459
Total	47,286,585	53,538,760	57,944,251	53,494,925	48,868,036
By Population Groups					
Class A—More than 1,000,000 pop	13,083,312	15,884,959	18,856,836	18,714,749	17,315,158
Class B—500,000 to 1,000,000 pop	4,083,575	4,717,941	5,325,020	5,111,777	5,011,890
Class C—250,000 to 500,000 pop	8,522,775	8,263,222	9,104,521	8,484,832	8,296,574
Class D—100,000 to 250,000 pop	8,244,707	9,394,458	8,927,954	8,672,320	7,912,153
Class E—40,000 to 100,000 pop	13,352,216	15,278,180	15,729,920	12,511,247	10,332,261
Total, all cities	47,286,585	53,538,760	57,944,251	53,494,925	48,868,036

cent less in 1929 than in 1925, and the ratio of bituminous pavement to the total pavement dropped from 70.4 per cent in 1925 to 62.1 per cent in 1928, rising to 65.1 per cent in 1929. The area paved with Portland-cement concrete amounted to only one-fourth of the total pavement laid in these cities from 1925 to 1929, but the yardage of Portland-cement pavement increased by half during the period, and its share in the total pavement grew from 19.3 per cent in 1925 to 30.0 per cent in 1928, declining to 28.5 per cent in 1929. Brick, block, and stone pavements, which constituted the remaining one-twelfth of the total pavement laid in the 201 cities, decreased one-third in yardage, and declined in relative importance from 10.3 per cent in 1925 to 6.6 per cent in 1929.

"Local preferences, based on such various factors as availability and cost of the different paving materials, cost of initial laying, local traffic conditions, or even custom and tradition, largely govern the choice of the type of street pavement. For example, bituminous pavements constituted 93.3 per cent of the total street surfacing laid in Michigan from 1925 to 1929, inclusive, but only 52 per cent of the total pavement in the adjacent State of Ohio, 57.9 per cent in Indiana, and 56.9 per cent in Illinois. In New Jersey they constituted 90.3 per cent of the whole, but in New York only 79.1 per cent, and in Pennsylvania only 73.5 per cent. In Massachusetts they amounted to 82.0 per cent of the total pavement, and in Connecticut to 97.0 per cent.

"In like manner, Portland-cement concrete formed

40.9 per cent of the total pavement in Indiana, but only 33.2 per cent in Illinois, 17.0 per cent in Ohio, and 6.0 per cent in Michigan. In the Middle Atlantic States, Portland-cement concrete made up 10.4 per cent of the whole in Pennsylvania, but only 6.9 per cent in New York, and 5.0 per cent in New Jersey. In New England 7.5 per cent of the street area in Massachusetts was surfaced with Portland-cement concrete but only 2.7 per cent in Connecticut. Similarly, brick, block, and stone pavements formed 30.8 per cent of the whole area in Ohio, but only 1.2 per cent in Indiana, 0.7 per cent in Michigan, and 9.9 per cent in Illinois. In Pennsylvania they constituted 16.0 per cent of the entire street surface; in New York, 14.0 per cent; but in New Jersey, only 4.7 per cent."

It is realized that "a five-year period does not adequately reveal tendencies in the construction of street improvements. . . . Of necessity, activity in paving is cyclical, especially in the smaller and less wealthy municipalities. More than one city, after raising money by a bond issue, has laid in a single year enough street pavement to meet its requirements for a decade."

The accompanying tables show the areas of street pavement laid in these cities, classified by types of paving, by geographic districts and by population groups.

In discussing these figures classified by types, the circular states: "Bituminous types constituted 70.4 per cent of the total street pavement laid in 1925,

(Continued on page 64)

Ditching in Hard Soil at 200 Feet Per Hour

By T. E. Dooling

The Smith-Booth-Usher Co., Los Angeles, Calif.

Faced with the problem of digging 100,000 feet of small trenches for an underground sprinkling system, within a specified time limit, the Brooks Co., Los Angeles, Calif., solved the problem by the use of a small ditching machine. The trench dimensions were $7\frac{1}{2}$ inches wide and 14 inches deep. The soil was that usually found in desert sections in the southwest, being abrasive, hard-packed sand with some stone.

The trench was dug at an average speed of 200 feet per hour, but the actual progress varied from 125 feet to 260 feet per hour, depending upon soil conditions. The cost of trenching was approximately \$7.50 per day, including gas, oil, and the operator's time.

Plenty of hand labor was available for this work, but due to the character of the soil and the time limit in the contract, the trenching was done by machine. The work was necessary in connection with the construction of an underground sprinkling system at the United States Naval Ammunition Depot at Thorne, Nevada. The trencher used was a Barber-Greene Service Special.





General view of completed bridge over upper San Francisco Bay

Unusual Bridge Construction Methods

Employed in Building Bridge Across San Francisco Bay

A BRIDGE has recently been completed across upper San Francisco Bay 5,603 feet long, containing seven 526-foot through truss spans, two deck spans of 264 feet and 504 feet respectively, one 328-foot vertical-lift span, 560 feet of viaduct at the south end and 220 feet at the north end. There were used in its construction 25 million pounds of silicon steel, 5½ million of heat-treated eye-bars, and 13½ million of carbon steel. The tallest pier is 207 feet from bed rock to bridge seat. This bridge was built by the Southern Pacific Railroad at a cost of twelve million dollars.

While this is said to be the longest and heaviest two-track bridge west of the Mississippi river, it is of special interest to engineers because of methods employed in constructing it. Chief among these was the creation of an artificial island of sand at each pier site, in which the pier was sunk to bed rock; the use of a deep-sea diver to examine the pier foundation under more than 100 feet of water; construction of piers to resist earthquake shocks; and use of one of the steel deck spans to support the falsework under each of the other spans during construction.

Preliminary surveys included soundings and diamond drill borings to determine the depth and nature of the rock, and the study of the cores and other data by geologists and paleontologists. These appeared to indicate that no earthquake faults crossed the line of the bridge. However, all the piers were designed to resist earthquake vibrations of twice the intensity of that which visited San Francisco in 1906, steel reinforcement being used at the rate of 30 pounds of steel to the cubic foot.

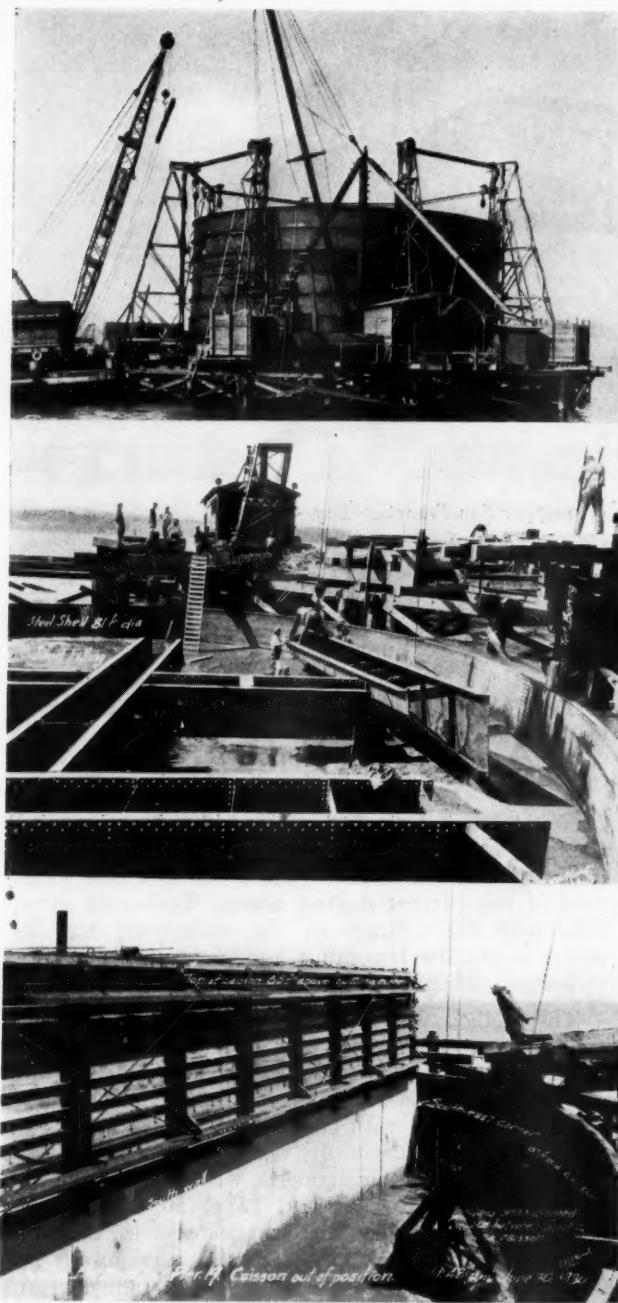
Method of Constructing Piers

The depth of water in the strait prevented open cofferdam work or the use of the pneumatic process.

It was proposed to sink caissons by the open well dredging method, but the depth of the water, a maximum tidal fluctuation of about 10 feet, the swiftness of the current during winter floods and at rip tide, plus the softness of the underlying bay deposits, made the launching and sinking of a timber crib most difficult.

The method finally adopted was as follows: Piles were driven around the pier site and an octagonal-shaped platform was constructed on top of the piles. On this platform were erected eight steel towers carrying winches with cables over sheave wheels located at top of frames. By means of this apparatus a steel shell 81 feet in diameter was erected and lowered through the water and 15 to 50 feet into the mud, depending upon the compactness of the mud. The shell was built up of circular sections 10 feet high, added one at a time as the shell gradually sank into the water. When the shell stopped settling it was filled with sand dredged from the surrounding waters. The island thus created within the shell permitted exact locating of the caisson and sinking it to a rock foundation.

A steel cutting edge for the caisson was built on the island, and portable steel forms were erected above it and reinforcing steel placed in them. Concrete was then poured in successive ten-foot lifts, constructing the wall of the caisson, as it was lowered. As this was done on the island, the crew was able to exactly center and orient the concrete mass as it settled toward bedrock; or, if it got slightly out of line, to draw it over by pumping out sand from between one side of it and the steel island shell. The caisson contained six wells, through which sand was removed from the bottom of the caisson by clamshell excavators, causing the caisson to settle gradually.



Top: Steel cylinder being settled in artificial sand island. Middle: Lower cutting edge of steel caisson being set in position on sand inside of steel shell. Bottom: Caisson being sunk. At the right is dredge bucket removing sand outside of caisson to bring it into position, the corner seen in the photograph being too high.



Floating erecting span into position to serve as falsework. It was first erected on the piling shown at the extreme left.

Use Deep-Sea Diver

When the caisson had settled to bedrock, and after practically all of the material immediately above bedrock had been removed by hydraulic jetting and clamming, a deep-sea diver was sent down to explore the bottom. He telephoned the conditions existing within and under the caisson, and gave accurate information as to the penetration of the cutting edge of the caisson into the foundation rock. With each inspection he brought to surface samples of the rock encountered, which furnished helpful data.

It is believed that this is the first time that a deep-sea diver has been used in the construction of bridge piers sunk to such great depth of water. His inspections permitted the engineers to verify the diamond drill borings and to know definitely the nature of the bedrock formation. The inspections also assured that the bridge piers were actually resting on bedrock with a full bearing.

Falsework Span

For erecting the steel spans of the superstructure various methods were considered, it being deemed impossible to use timber piling successfully and economically owing to the depth of the water, softness of underlying mud, water current, and the height of piers above water. It was finally decided to use one of the steel spans as falsework for the erection of all other spans, this span finally being placed as the most northerly span in the bridge. It was erected on piles driven in the shallow waters at the south end of the bridge; on its completion it was floated by means of two steel barges from its original position to a position between the first two deep-water piers at the south end of the bridge, and rested on shoulders provided in the construction of the concrete piers. When in position, the top of this span was below the level of the permanent span to be constructed here and gave temporary foundation on which to erect the permanent span. After the permanent span had been completed, the falsework span was again floated on steel barges and moved into a new position between the next two piers.

Storm Sewer Designing in St. Louis

Since 1908 all sewers in St. Louis, Mo., have been designed on the so-called rational theory basis. This involves computation of the run-off from as accurate rainfall records as can be obtained and automatic rain-fall gauges are located at various points throughout the city and their records gathered by the two gauge readers. From these records, rainfall curves have been drawn up showing the intensity of rainfall at the different localities for various periods of time, which curves are used for computing the discharge or runoff which the system is to be designed to carry. Previous to the use of the rational theory St. Louis sewers were designed on the basis of empirical formulas, in the use of which assumptions for rainfall intensity were made. Lacking accurate records of rainfall, the efficiency of the sewers depended entirely upon the experience and good guess of the designers. Undoubtedly the capacity of the laterals at the upper end of the system was greater than necessary. From about 1887 to the time the city changed over to the rational theory of sewer design, McMath's formula was used.

THE EDITOR'S PAGE

Here's Your Hat. What's Your Hurry?

WE respectfully call the attention of our readers to some of the letters on the page following this one. We also wish them to read carefully the item in *The Water Wheel* on page 40 of this issue, in which is discussed the effect of politics on water works superintendents, and their tenure of office.

It may safely be assumed that the majority of these men were able to do the work satisfactorily, and their removal represents a distinct loss to their communities economically and from the standpoint of health and service.

Can not the two large water works associations, with the assistance and cooperation of the American Engineering Council and its members, succeed in working out a uniform law that will give these men at least as much protection in their work as firemen and policemen now have? To accomplish results along this line will take time, effort and thought, but it will be more than worth while. There is little to be gained in teaching a man how to do his work better, while not safe-guarding reasonably his tenure of that office. If the technical associations are to render their maximum service, they should bend their efforts as much toward improvement of working conditions as toward better technical knowledge.

A New Feature for Our Readers

For many years the editors of PUBLIC WORKS have made it a point to dig through municipal reports, papers and other sources of information not available generally to engineers, and have abstracted therefrom many items of valuable information on methods, processes and results. This arduous (and sometimes soporific) work has been cheerfully done because of the many expressions we have received from our readers in regard to the value of such information.

Hitherto these items have been scattered throughout the reading pages of the magazine. Our readers will now find them concentrated under appropriate headings so that reference to them will be easier.

More Efficiency in Construction

A series of articles being published in this magazine points out many ways to economy in motor truck operation; last fall we published some excellent articles on efficiency in concrete highway construction; and the Bureau of Public Roads has contributed to the general fund of knowledge the results of some valuable studies on mixer and shovel operation.

Efficiency or economy in construction is measured in financial results. Whether efficiency is accomplished by securing a greater daily output of work, or by doing the same work at a lower cost, the yardstick of measurement is the money saved. Therefore, cost-keeping is necessary to determine whether or not economy has been secured. It is also necessary to determine just when a piece of machinery can no longer pay its way and should be replaced by more modern equipment.

One of our foremost motor truck manufacturers (name on request) has just compiled and is distributing a cost-keeping book for motor truck operation. To keep such a record requires a minimum amount of time. If it is done, there need be no guess-work in regard to truck operating costs. But it might cramp the bidding style of some of those eternally optimistic contractors that seem to appear so frequently these days.

Debts of Cities

Every so often we hear of the tremendous debt burdens that many cities are carrying. But a tabulation of the bonded indebtedness of 257 cities, just published in the *National Municipal Review* does not appear to bear out the more or less general impression that our cities are in bad financial condition. The per capita net debt of these cities varies from \$14.81 for Rockford, Ill., to 386.69 for Atlantic City, N. J. Washington, D. C., has no debt. Of the thirteen cities of more than 500,000 population, ten have less than \$140 net debt per capita. Of the twelve cities tabulated which have a population of 300,000 to 500,000, only one, Newark, N. J., with \$140.68, is above the \$140 mark and six of them are under \$100.

Careful control of public expenditures is always desirable but municipal officials should not be frightened into untimely curtailment of necessary public improvements.

The Buses

There is a good deal of squabbling going on between the bus lines and railroad and other interests. Both are necessary to the convenience and prosperity of the country. In the end, a good deal is going to depend upon the sympathies of the public, which sympathies are going to reflect the benefits derived from these public utilities.

The bus interests can stand a lot of improvement. Chief among these are better equipment and better operation. Considering the latter first, we can cite the numerous complaints that buses do not adhere to schedules; they leave 5 minutes early; or they discharge passengers a block or two from the usual destination, to the detriment of waiting friends, but for the convenience of the bus driver. Too many of the drivers are a law unto themselves. Information service is unreliable.

These are merely irritating, however, and result mainly in inconvenience, verbal tilts and more or less ill-feeling on the part of would-be patrons. What is more serious is the antiquated and unsafe equipment operated on so many lines. Worn-out buses, made-over touring cars and similar unfit equipment ought to be retired and replaced with the safe and modern buses now available. With physical equipment at a high standard, the operating personnel will be better, and there will be a material reduction in operating risk, with increased safety and convenience to the traveling public.

THE READERS PAGE

The Water Works of Battle Creek, Mich.

(From a letter to PUBLIC WORKS by Superintendent Brigden)

We have a water works with over 100 miles of mains, nearly all 6-inch or larger and up to 24 inches diameter. We had two bond issues, of \$100,000 and \$30,000 respectively, in the early days of our works, but now have no indebtedness of any kind except current bills. We have \$160,000 in the water fund, and if the Park Department had not been allowed to have all its mains and services put in without cost to itself we would have about \$200,000.

We receive nothing for the rental of hydrants, use of water for public parks, buildings or in fact any public purpose, and are even furnishing free water to a few other parties and corporations, but not many.

We paid nearly all the interest on what water works bonds we had during the early years of operation of the works, and a good part of the principal. We estimate that, if we take the value of the water works as it is at present and figure our outlay and income, the water works has more than paid for itself, and the city has a plant worth at least two million dollars free of any cost. It was contemplated originally that the city might either put up a plant or give a franchise for one, but it was decided that the city should own its own works, and this decision seems to have been fully justified by the results.

I am enclosing a copy of our water rates, which were adopted in 1924-26. [These run from a maximum of 16 cts. a thousand gallons for amounts up to an average of 500 gallons a day, decreasing by 1-cent decrements to a minimum of 8 cents for 150,000 to 400,000 g. p. d., for consumers inside the city, all rates being 50% greater for those outside the city; with a minimum of 50 cts. per month. Editor] Before that time we had a much lower rate—in fact, a rate for small users altogether too small, running from 5 cts to 13 cts. a thousand gallons, according to the amount used, and the minimum yearly rate was only \$3.00, which of course did not pay for the bookkeeping, reading, or keeping in repair.

I have not read of any works that have done as well as we have, and would like to hear of any that have equalled or excelled Battle Creek in this respect.

We have a pressure in the lower part of the city from 65 to 85 pounds and are well provided with hydrants

and valves; although I can not say that we have quite as good buildings as some other cities in Michigan.

I have been the head of the water and sewer department for over 44 years, and have been engineering altogether, covering both railroad and city work, about 57 years of my life. I was city engineer of Erie, Pa., for a little over four years before I came to Michigan.

W. W. BRIGDEN,
Superintendent and Engineer,
Department of Public Works.

(Compare the last paragraph of the above with the following extract from another letter sent us from another state.)

"My change of address is made necessary by the fact that, after 25 years of faithful service to this municipality as manager of their lighting, water and sewer utilities, I am set aside by a change in administration, presumably as an economical measure."

(And with the following from the 1930 report of the Department of Public Utilities of Richmond, Va.)

"In 1908 Mr. Eugene E. Davis was elected superintendent of water works. Mr. Davis had been in the employ of the city since September, 1872. He continued in the position as superintendent of water works until his death on July 20, 1925. His record of continuous service to the city was fifty-three years."

The department, which published this to give credit to its superintendent, is itself deserving of credit for retaining him so long in its service.

Editor, PUBLIC WORKS:

We have used a winch mounted on a Caterpillar Tractor for unloading pipe from a truck and lowering it into the ditch. The outfit used was a Model PA-20 Cardwell All-Steel pipe winch, mounted on a Model 20 Caterpillar Tractor.

The machines were not used extensively, but to some extent on both sixteen-inch and eight-inch cast iron installations. Where the ditch was ready, about three times as much pipe could be handled as with a hand operated derrick. On longer lines of heavy pipe, the machine would probably operate proportionately much faster.

When handling the pipe with the winch, one less man was required on the job for both eight-inch pipe and sixteen-inch pipe than the regular crew. Two laborers were released from the pipe handling crew, but one machine operator was necessary. The laborers here

are paid 40c an hour, while the machine operator draws from 80c to \$1.00; so there was no saving in point of labor.

The cost of operating the outfit as near as I have been able to learn was approximately \$2.50 per day for gasoline, oil and grease, if in use continuously for eight hours, handling any medium size pipe. I am unable to give you any idea as to the cost of upkeep on the machine, but do not see how the expense could run much over that of operating a Caterpillar tractor of similar size on any ordinary construction job.

The Model PA-20 winch costs, I understand, \$1600.00 at the factory and is mounted on a Model 20 Caterpillar which costs somewhat in excess of \$2000.00. For short installations, such as practically all of ours are, the initial cost is such that with the operation cost added any saving would be small and necessarily extended over a long period.

To any company engaged in pipeline construction, laying lines of considerable length, particularly in ten, twelve, sixteen-inch and larger, the winch should prove a very profitable investment and would undoubtedly operate at a considerable saving.

Yours truly,
J. J. FARMER.

Editor, PUBLIC WORKS:

It seems to me that governing bodies of small cities and towns make a great mistake in stopping all public work during times of depression.

In times of great unemployment public work should be pushed to the limit, within reason. It is much easier to pay for work put in during depressions, at a later date, than it is to starve during unemployment while waiting for times to improve.

BURWELL BANTZ,
City Engineer, Chehalis, Wash.

Editor, PUBLIC WORKS:

The North Carolina State Legislature has recently enacted the Connor Road Bill providing that the State Government shall take over all public roads in the state, to be maintained by the state.

This takes all the road work away from the county units and places it under the direction of a state-wide commission of seven members to be appointed by the governor. It is purposed to maintain the roads by the use of convict labor and the state is to take over all road machinery, equipment and supplies from the counties.

GEO. W. TIDD,
County Engineer.

South Greensboro Sewage Treatment Plant

By C. W. Smedberg

Director of Public Works and Service, Greensboro, N. C.

(Continued from the June issue)

Primary Sedimentation Tank—The sewage pump discharge enters the primary sedimentation tanks through an influent channel and weir extending the full width of the tank, which is of the Dorr type. The tank is 70 feet square, with a side wall water depth of 11 feet, and is provided with a traction type sludge collection mechanism. The effluent is discharged, opposite the inlet, over a weir into an effluent channel extending the full width of the tank, whence, by means of a 30-inch cast-iron pipe line, it may be carried to the dosing tanks of the sprinkling filters or direct to the creek without further treatment.



Primary sedimentation tank, showing sludge mechanism.

roof and 12-inch earth fill. Access to the tank is provided by two 36-inch manhole openings.

Sludge may be introduced at two points through the tank roof through 4-inch pipes. Two 8-inch sludge outlets, one at the tank bottom and the other midway of its depth, enable withdrawing of the sludge or recirculating in the digester.

Two steel gas domes, 3 feet by 5 feet, are anchored to the concrete roof. They have water and gas outlets, and a 6-inch drain to permit withdrawal of scum accumulated in the gas domes.

The tank supernatant is withdrawn through two



General view of sludge drying beds.

The sludge is drawn from the tank through an 8-inch cast-iron line by means of a 3-inch Yeomans Brothers motor driven centrifugal pump and discharged into the digestion tank.

Sludge Digestion Tank—The sludge digestion tank is of the Dorr type, circular, 60 feet in diameter and 23 feet deep, and provides a digestion capacity of two cubic feet per capita for an ultimate contributing population of 32,500. The tank is covered with a concrete

8-inch overflows, which, with a scum drain, are connected to an 8-inch drain line, which discharges into the incoming 36-inch inlet lines at the control chamber.

Heating of the tank is contemplated through the collection and burning of the tank gases under a water heater and the circulation of hot water through coils within the tank. The gas collection system incorporates the usual equipment, moisture trap, gas meter, pressure relief trap, and flame trap. A six-burner Bryant type 5 W 43 gas boiler with automatic heat control is used for the burning of the gas and heating of water, which is circulated by a motor-driven centrifugal pump through the heating coil within the digestion tank. The heating coil is continuous, of 2½-inch pipe, 540 feet long, and occupies four feet of wall surface immediately above the tank bottom. Bristol recording thermometers placed in the circulating pipe system record the ingoing and outgoing water temperatures.

Sampling lines of two-inch pipe enable withdrawal of sludge from the tank at four points along the depth of the tank for observation and control purposes.

Control House—The operation of the digestion and sedimentation tanks is controlled from a control house



Sludge drying bed. Stone and part of sand in place.

located adjacent to the digestion tank, having a main operating floor at grade level and a substructure or basement beneath. On the operating floor level is located the electrical control and lighting panels for the operation of the digestion and sedimentation tanks, the Bryant heater and circulating pump, and a Wallace and Tiernan dry-feed machine for the adjustment of the digestion tank.

The basement provides for the gas collection traps

and the centrifugal sludge pump for the withdrawal of sludge from the sedimentation tank and pumping to, and circulating of, sludge in the digestion tank. Control valves and pipes for the withdrawal of sludge from the digestion tank, either by gravity or by pumping to the sludge drying beds, are housed within the substructure.

Sludge Drying Beds—Six sludge beds, 52.7 feet by 103 feet, grouped three on each side of an operating aisle, provide a total drying area of 32,500 square feet.

Each of the beds is enclosed by a 6-inch concrete wall 3 feet high and provided with 4-inch concrete floor. The drainage system of each bed consists of a main drain of 8-inch half-tile laid on the concrete floor, through the center of the bed along its longest dimension, with four 6-inch half-tile placed on each side of the main drain and perpendicular to it. The floor of the bed for its entire area is covered to a depth of seven inches with broken stone graded from 2 inches to $\frac{1}{4}$ inch and supports 12 inches of sand. The individual bed drains discharge into a 10 inch vitrified clay pipe line in the operating aisle, which discharges into the creek. The sludge flow to the beds from the control house is through 10-inch cast-iron pipe lines, provided with shear gates. An industrial track system with steel side-dumping cars facilitates the removal of the dried sludge from the beds.

Dosing Tanks—Two pair of twin dosing tanks, each approximately $35\frac{1}{2}$ feet by $42\frac{1}{2}$ feet in plan, serve the filter beds with sedimentation tank effluent, 6-inch air lock feed Pacific Flush Tank Company siphons being used. Six-inch drains allow draining the inlet channel, troughs, and siphon chamber, into the inlet line.

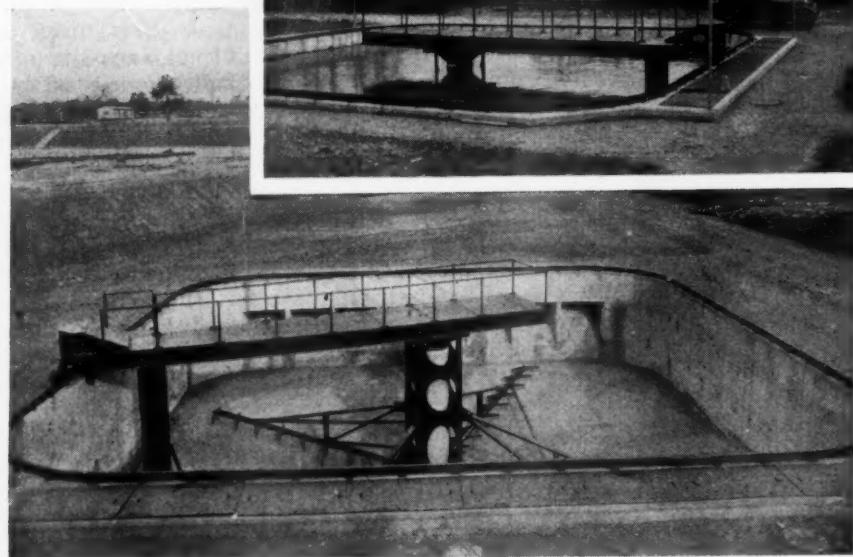
Sprinkling Filter Beds—The sprinkling filter bed is rectangular, 201.33 feet by 396.0 feet, enclosed by a reinforced concrete wall of cantilever design, extending one foot above the stone level, with a concrete wall dividing it into two equal units. Each filter has a 6-inch reinforced concrete floor or bottom sloping 6 inches from

(Continued on page 56)



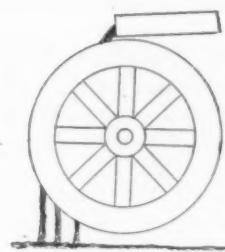
Sprinkling filter under construction. Above—Placing stone on "Metro" block floor. Below—Main and lateral distribution pipes. Stone screen and hopper in background.

Secondary sedimentation tank. Full and empty.



THE WATER WHEEL

By
Jack J. Hinman, Jr.



THE bulk of water works literature during May and early June was greatly increased as a result of special editions of magazines prepared for the meeting of the American Water Works Association at Pittsburgh, late in May^{68, 155}. Some of the many interesting papers presented at that convention have already begun to make their appearance.

Design

Engineers are not in agreement as to the best way to **specify sand** for filter plants. Some believe that the "effective size" developed by Hazen in about 1892 is satisfactory, but others are of the opinion that it does not supply the information required to forecast the behavior of the sand in filters³⁸.

In preparing designs for plants, rational long-range planning is to be greatly desired⁴⁸ in order that there shall be a proper economic balance in future extensions⁵¹. Accurate estimates of future populations are difficult to secure and the methods by which they are commonly deduced need frequent checking and revision⁵². The peak load consumption which may reasonably be expected must be foreseen so there are design limits imposed by economic considerations⁵³. Water requirements in buildings must be estimated in order that house piping may be adequate³⁷ and simple methods should be developed for the making of similar estimates throughout the system⁷⁹.

Wood stave pipe introduced into Europe about ten years ago has been used in a number of German installations⁷⁸. Cast iron pipe laid in Philadelphia in 1817 was found to be in excellent condition when inspected recently^{35, 143}. The length of life of cast iron pipe, which is not exposed to electrolysis and the like, is still unknown. A recent inspection by Burt Hodgman showed the cast iron pipe laid at Versailles during the reign of Louis XIV to be in excellent condition notwithstanding over 260 years of use⁸⁶. New standards for pipe flanges have been published in France following an international conference at Zürich in 1929. The so-called City of Paris flange specifications have been much used in France¹¹⁸.

Earth dams and the material of which they are constructed formed the subject of a symposium^{70, 71, 72, 73}. A prize contest was held in the attempt to improve the appearance of the elevated steel tank^{134, 160}. The proper methods of well construction⁸¹ have been explained by Fiedler. Higgins⁹⁷ and Kirchoffer⁹⁶ have continued a discussion of the hydraulics of wells begun by the late L. M. Balch in the Journal of the American Water Works Association in June, 1930. A German device protects the submerged motor of a

The essential features of important articles of the month having to do with water works design, construction and operation and water purification, arranged in easy reference form and condensed and interpreted by a leader in the water works field. Published every month to include articles appearing during the preceding month.

deep well pump by enclosing it in a kind of diving bell¹⁰⁰. The effect of the area of the reservoir on the discharge of an overflow weir has been the subject of comment by Robinson¹²⁰.

In the field of water purification an unusual color removal plant has been developed to meet the special conditions of well waters at Los Angeles. The steps in the development of the plant, which departs radically from the accepted practice in a number of details form the subject of a paper by Dr. Carl Wilson⁸⁸. The University of Iowa has completed and put into service a new water plant designed to facilitate instruction in water purification as well as to treat the water supply of the University which approached one million gallons per day. The source is the Iowa river¹³². Haddaway¹⁵⁰ enumerates the various steps required to promote and construct a water works for a small town or village. British interest in American practice is seen in the continuation of the articles by W. Gordon Carey^{117, 121}.

Construction

New York is continuing tunneling operations deep in the rock^{22, 25} and with the approval of the Supreme Court for a limited diversion of water from the Delaware river³⁹, will soon embark on a great project for increasing the city's water supply at a cost of \$272,587,000. Several tunnels are involved, one of which will be 22 miles long^{24, 144}. The Metropolitan Water Supply Commission, of Boston, has awarded the contract for a ten mile tunnel to divert the water of the Ware river to the Swift river. The work is expected to take four years and to cost nearly five million dollars¹⁴⁷. The contract for 47½ miles of the Hetch-Hetchy pipe line for San Francisco was let May 22nd at \$4,136,479. Twelve months are allowed for this work⁶⁵. Vancouver, B. C., will build a 7-foot tunnel to carry water under the First Narrows in the harbor, thus increasing delivery of water to the city^{43, 60}.

The difficulties encountered in the construction of the Boyati tunnel for the water supply of Athens, Greece, are detailed by R. K. Keays, of the staff of Ulen and Company⁷⁴. Most of the construction was in compact marble which required large quantities of explosives, but chlorite schist rapidly destroyed concrete block linings and necessitated a slight change in the original plan. Interesting methods were used in the construction of the two mile 21-foot tunnel at Dearborn, Michigan²³. The British practice in regard to long water supply lines and tunnels is explained by Barnett¹²².

Numerous descriptions of existing supplies appear

in articles during May. Most frequently described was the supply of Pittsburgh, the convention city of the American Water Works Association¹, 125, 158. Other supplies were Racine, Wisconsin¹⁶³, Rockford, Illinois²⁰, Norfolk, Virginia³², ³³, Mobile, Alabama¹⁵³, and Daytona Beach, Florida¹⁴. Canadian supplies described were those of Niagara Falls, Ontario²⁶, and Windsor, Ontario³⁰. The filters of the Halifax Corporation¹¹³, the reservoir and water tower of the Southall plant of the Southwest Suburban Water Company¹¹⁴, the new reservoirs of the Coventry Corporation¹¹⁹, and the new surface water plant of Rhosneigr, Anglesey¹¹⁵, are illustrated and explained in English engineering papers. Walker⁸⁷ reports that he was much impressed by the excellence of design and operation of water works equipment at Moscow, Russia. The Managua, Nicaragua, water works is reported to have been restored by U. S. Army engineers⁴⁶.

Sheboygan, Michigan, is now being served by a new filtration plant¹³⁵ and **Albany, New York**, expects soon to have the Hannacroix creek water available⁸⁰. This \$6,000,000 project includes a filter plant at Feura Bush.

The State Department of Health of Virginia has recently issued a booklet¹¹⁰ on the public water supplies of the state. There is a general summary of water supply practice and a description of each supply. Pictures are shown of the Salem, Virginia, filtration plant. The behavior of the different supplies during the **drought period** is indicated. Wilson¹⁴⁰ gives a review of the water supply problems of **Southern Saskatchewan** with particular reference to the vicinity of Moose Jaw.

Smaller construction items include a new million-gallon elevated tank for High Point, No. Car.¹⁰, a covered concrete reservoir at Springfield, Mass., of 11-million gallon capacity⁶⁷, and the installation of a new 20-million gallon pumping unit at Cambridge, Massachusetts³. Provo, Utah, has built a new 5-million gallon gallery-type **underground reservoir**. The Pinellas Water Company, which is to supply St. Petersburg, Florida, with water in bulk, has constructed an entire new supply system including a 26 mile supply main in a period of ten months⁴⁷.

The cost of laying 6,689 feet of **48-inch main** at New Bedford, Mass., amounted to \$25.11 per foot¹⁶⁵. In Portland, Maine, a 24-inch Universal pipe was laid through 600 feet of mud flat and then carried **under a railroad track**, using shield tunneling without disturbing traffic on a busy railroad line. Armco iron culvert 60 inches in diameter was used for the shield¹⁴⁵. At Newport, Kentucky, a 20-inch valve was inserted into a main at a bridge crossing² using an A. P. Smith valve inserting machine, and at Ogdensburg, New York, a 30-inch horizontal valve was inserted and a 24-inch branch made to the main using the same type of equipment¹³⁹. Pressure was maintained. **Lowering a 30-inch cast iron main** from $2\frac{1}{2}$ to 8 feet while a pressure of 50 to 80 pounds was maintained on the line, was successfully accomplished at Hartford, Connecticut, at an average cost of \$10.30 per foot¹²⁶.

Proposed extension at Salt Lake City includes the development of an **artesian auxiliary supply** and the purchase of water rights and property of water companies taking water from the Little Cottonwood, Big Cottonwood, Spring Creek and Mill Creek streams. A $33\frac{1}{3}\%$ **increase in rates** is contemplated^{62, 152}.

Extensive improvements are planned for the water and power systems of Los Angeles⁶⁶. Fresno, Califor-

nia, plans to **replace mains**¹⁴⁸. Lincoln, Nebraska, has had difficulties with its well system producing water **higher in salt**. A thirty-mile pipe line to the Platte river capable of supplying 15 million gallons per day is to be installed⁵⁹. The Hackensack Water Company plans to put in an **8-mile pipe line** using 62-inch Lock Bar pipe¹⁴⁶. At Quebec an **underground reservoir** is to be built²⁸.

Management

It is the opinion of George W. Biggs that while much estimating of the depreciation of water works property has been arrived at in a strictly theoretical manner, or by lightly veiled guesswork, **accrued depreciation is an existing fact** and that it is determinable with reasonable accuracy if common sense and experience are employed¹²⁷.

A series of replies to **questionnaires** regarding water rates and regulations of water departments is being published by the American City magazine⁶. It is to be hoped that the information will not be used as so much of the information of questionnaire type is employed, namely in an attempt to force down water rates without any regard to the inherent differences in the places compared with regard to available water, differences of topography and the need to provide for replacement of depreciated equipment. Some water departments, such as that of Charlotte, North Carolina¹³⁸, are able to return a **reasonable surplus** and invest it in new construction or in replacements; other departments find it difficult to make the necessary profits. The problems of **utility financing**, whether of the municipally owned plant⁹⁰ or of the privately owned plant⁴⁹, are sufficiently difficult. In some cases the **fundamental justice of metering** all water supplied to public and private consumers is not recognized. A plan to meter the city supply of Baltimore was **disapproved** by the city and the legislature¹³⁶. On the other hand, although 100% metering cost San Antonio \$400,000, it enabled the city to **reduce ordinary rates 5%** and other rates even more. Every effort must be made in the interest of economical operation to **reduce all avoidable losses**. Frank C. Jordan discusses the manner in which better design and better operation can be made to reduce these avoidable wastes^{11, 84}. **Studies of personnel** may enable important improvements in service to be secured, according to C. A. Dykstra, city manager of Cincinnati¹⁵⁴.

Water companies in New York State have been made to come under the control of the **public utility commission** by the provisions of the Thayer bill recently signed by Governor Roosevelt⁴¹. Municipally owned water plants in cities of more than 50,000 are exempted from many of the provisions but must file copies of their annual reports. The new law becomes effective July 1st. The **Water Power and Control Commission** of the state of New York also has jurisdiction over certain phases of the business of the water companies and departments according to Russell Suter, chief engineer of the commission¹⁴⁹. The question as to the authority of water companies to exercise the right of **eminent domain** has been raised in New Jersey¹⁵⁶. It is apparent that the interpretation of **water supply legislation in England** is clouded by anomalies in that country as in this¹¹⁶. Various schemes are employed in **selling water to out-of-town customers**^{93, 94}. Seattle, Washington, however, has been denied the right to compete with the Mountain Lakes Company in the sale of water in the district lying be-

(Continued on page 40)

Still on the Job after 100 Years



Unretouched photograph of section of 100-year-old cast iron water main still rendering efficient service in Philadelphia's water supply system. (Inset) Mayor Mackey (right center) and Director of Public Works Murdoch inspecting section removed to cut in hydrant—Chief Hayes at microphone.



"**L**ADIES AND GENTLEMEN, at this corner (Fifth and Federal Streets) we have taken up water pipe that has been in the service of the people of Philadelphia for over a century. Notwithstanding the great changes that have taken place in our city, this cast iron pipe stands perfect in all its integrity as disclosed to us tonight after having made the excavation and taken out a section." . . . (Excerpt from a speech by Mayor Mackey of Philadelphia in a radio program during the inspection of a 100-year-old cast iron water main.)

In the words of the radio announcer: "This event had its inception when the Bureau of Water Supply discovered, upon cutting in a hydrant, that below the surface of this street there is a cast iron pipe which was laid more than a hundred years ago. It is still supplying this section with water as efficiently as ever. Just a few squares away there lie buried at Front and Chestnut Streets 1680 feet of cast iron pipe laid 109 years ago, the oldest cast iron water main in the country."

Still serving many of our older cities are cast iron gas and water mains that were laid 90 to 100 and more years ago. These long-lived cast iron mains are probably the only example of century-old engineering material which is still giving satisfaction under the radically changed conditions of today. Cast iron pipe's long life has saved millions of dollars to taxpayers.

The reason for the long life of cast iron pipe is its effective resistance to rust. Cast iron is the only ferrous metal which will not disintegrate from rust. This characteristic makes cast iron pipe the most practicable for underground mains for rust will not destroy it.

Every taxpayer should take an active interest in the kind of pipe being laid, or to be laid, in his community. For further information write to The Cast Iron Pipe Research Association, Thomas F. Wolfe, Research Engineer, 122 South Michigan Ave., Chicago, Ill.

Cast iron pipe bearing the "Q-check" trademark is obtainable from the following leading pipe founders: Alabama Pipe Company, Anniston, Ala.; American Cast Iron Pipe Company, Birmingham, Ala.; James B. Clow & Sons, 219 N. Talman Ave., Chicago, Ill.; Donaldson Iron Company, Emaus, Pa.; Glamorgan Pipe and Foundry Company, Lynchburg, Va.; Lynchburg Foundry Company, Lynchburg, Va.; National Cast Iron Pipe Company, Birmingham, Ala.; United States Pipe and Foundry Company, Burlington, N. J.; Warren Foundry and Pipe Corporation, 11 Broadway, New York.

CAST IRON

Look for the "Q-check" symbol as shown above.
It is the registered trademark of The Cast Iron Pipe Research Association.

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CAST IRON PIPE

The above page advertisement of The Cast Iron Pipe Research Association will appear in Time, July 27th—Collier's, August 1st—Saturday Evening Post, September 19th. Total circulation over five million.

For latest catalogs—consult the *classified INDUSTRIAL LITERATURE* section, beginning on page 83

tween the city limits and those of Everett to the north⁶¹. The Mountain Lakes Water Company, through its parent organization, Ulen and Company, plan a \$4,000,000 gravity system to supply the district. Lake Marion, which is to be the chief reservoir, will be cleaned, drained and a dam installed¹⁵⁷.

The bane of politics in the water departments of the country is discussed by R. E. McDonnell¹²⁹, who states that in 75% of the cities and towns of Indiana in which there was a political overturn at the last election, the water works superintendents were discharged and replaced. It is said that of the superintendents of water works in the states of Indiana, Illinois, Iowa and Missouri, about 15% lose their jobs every year. This is not to the advantage of the communities either economically or from the standpoint of health and service. A well defined continuous policy is essential¹²⁹.

The New Orleans Sewerage and Water Board has been reorganized. Bryson Vallas, former city engineer, replaces George G. Earl as General Superintendent⁴². New York City has purchased the Long Island Water Company plant and system supplying the Rockaways⁷.

C. H. Koyl, veteran water service engineer of the Chicago, Milwaukee, Saint Paul and Pacific Railroad, points out the value of clean, soft water to municipalities as well as to railroads. He points out that 134 cities were softening municipal water supplies at the time he prepared his paper on the subject²¹.

In discussing charges for sprinkler fire protection, L. R. Howson points out the necessity of a reasonable ready-to-serve charge and states that in an ordinary city of 50,000 to 100,000 population about 25 to 35% of the income of the water department should be for fire protection service. Few citizens realize the amount of the additional investment in mains, pumps and other equipment made necessary by the provision for fire demand for water¹⁶².

A series of humorous advertisements stressing the availability and reliability of the water in the communities served has been prepared by the American Water Works and Electric Company. The advertisements are in the form of cartoons and jingles¹⁵.

Operation

A sub-committee of the Metropolitan Water Board of London has prepared a report on burst water mains based on the Board's experience with some 7,200 miles of water mains ranging in size from 2 inches to 96 inches diameter¹¹². Excessive pressure in domestic heating systems concerns the water works superintendent chiefly thru the damage that may result to his meters. Check valves between the boiler and the meter may however lead to explosions of the boiler due to the pressure built up. Proper relief valves are needed³⁶. Results of a series of tests run on service pipes of various materials, which lead him to favor copper pipe, were reported by R. W. Reynolds⁸⁵. Other operators expressed different opinions. E. T. Cranch explained a simple method of raising valve boxes to conform to pavement grades using an adaptor⁴.

At Montreal a photo-electric apparatus has been developed to maintain the desired dosage of chlorine and has been in successful use since September, 1928⁹⁵. Apparently starch-potassium iodide solution is used as the indicator and the blue color produced in the presence of free chlorine is used to obstruct the beam of light which otherwise would fall on the light-sensitive cell. At Beulah Beach, Ohio, the permanent population is very much smaller than the transient

holiday population. The total quantity of water pumped is small. HTH is used for chlorination and close control of the dosage is essential to control purification during population peaks. A new chlorine vehicle called Heyden chloramine (or paratoluolsulfon sodium chloramide) has been placed on the market. It contains 24.4% available chlorine, has no color, has great fixity and is claimed to be harmless.

Warning to prepare for algae troubles has been sounded by J. R. Baylis who discusses most of the algicidal procedures and odor removal processes in current use¹⁵⁹. At Spartanburg, S. C., algae became so numerous that they shortened filter runs to 1½ hours and increased the amount of wash water to 25%. Copper sulfate treatment was employed as a remedy¹⁴². At Pulaski, Va., leakage through a rockfill dam was recovered and treated with chloride of lime before returning to the 200 million gallon reservoir from which the water had escaped. The chlorine diffused into the bulk of water and acted as an effective algicide⁶⁴. In the Wanaque reservoir organic matter caused depletion of oxygen and development of hydrogen sulfide and carbon dioxide in the deeper water, while the surface water contained excessive amounts of plankton. These were killed with copper sulfate so that the water at the surface could be used before the middepth water became too bad tasting. Selection of water from different depths may be of assistance³⁴. The use of activated carbon for water purification has been thoroughly reviewed in German by Koenig⁷⁶.

Although the modern tendency is to put greatest emphasis on the preparation of the water for filtration, filter operators are anxious to get the best service from the filters under their control. The manner of operation to secure these results from rapid sand filters is described by Ulrich¹⁴¹. The importance of prechlorination has been investigated by Streeter and Wright and a report of their work appeared in Public Health Reports some time ago. A review of the work has been published in the Surveyor, of London¹⁰⁶. Potter and Klein⁹¹ found the use of ferric iron coagulation very helpful in treating the water at Mamaroneck, New York. A publication of the U. S. Bureau of Mines¹⁰⁹ under the title of "A Compendium on Limes in Hydrometallurgy and Flotation" includes some data on lime which will be useful to water plant operators.

A heavy trash rake for removing debris from racks in deep water has been developed by the hydraulic development department of the Aluminum Company of America⁹⁹. It is able to remove whole trees from the trash racks. At Washington, D. C., a telephone call to one of the reservoirs causes the receiver to be lifted from the hook and a number of buzzes by a loud speaker in front of the telephone transmitter enables the height of the water in the reservoir to be known. The apparatus does not interfere with the normal use of the phone for calling numbers from the reservoir station⁹².

Dependability of water service requires preparedness to meet emergencies. A number of cities describe in a symposium the procedure they have taken to meet such conditions⁵⁵. At Omaha, Nebraska, the scheme of housing all activities in a service building has been of great assistance⁵⁴.

The water consumption of St. John, N. B., is the highest in Canada, amounting to 242 gallons per capita from one source and 302 from another²⁷.

In England the ball hydrant which has been in use has been recommended replaced by the Ministry of

(Continued on page 68)

for year 'round maintenance

most flexible power unit...low operating cost with ample speed and power...

FWD Trucks are widely accepted by State and County Highway Departments . . . over 75 per cent of our states own and operate them . . . A preference built on performance, for the FWD is the most flexible of power units, economically suited to year 'round road maintenance.

While this recognition is gratifying, it is not surprising...The FWD Truck is built expressly for this heavy service . . . it has the power, speed and above all, positive traction so important in road building, road maintenance and snow removal.

The FWD is not an ordinary truck . . .

it is different in principle, more than a truck, a power unit which drives and brakes on all four wheels . . . distributing the power equally to each wheel, thus putting all power developed to actual use . . . With the load evenly carried on each wheel, the strains are not placed on any one section of the chassis . . . in essence, it is the principle of "Pulling" so ably and economically used in FWD Trucks.

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FWD Trucks are made in 2 to 10 ton sizes, including four wheel, six wheel and tractor trucks. Send for specific folders.



Design and Construction Of
HIGHWAYS
 and
PAVEMENTS



**Unusual Form Work in Concrete
 Paving**

INGENUITY was shown by W. A. Wilson & Sons, general contractors of St. Mary's, W. Va., in connection with resurfacing work on a state highway in Cabell County, W. Va., in which an old 18-foot brick road was resurfaced with concrete and widened to 20 feet.

Because of unevenness of the old brick pavement and also because of many super-elevated curves, it was necessary to increase the thickness of the outer edge of the pavement to 14 inches. This was accomplished by doubling the road form height through the simple procedure of setting one 7-inch road form on top of another and staking both forms at the same time with the same stake. This was possible because the stake pockets in the forms lined up per-

fectly and presented no obstruction to the staking operation.

The concrete was laid in two ten-foot strips. This necessitated setting the inside road forms in the middle of the old brick pavement, and jackhammers were used to drill the holes for the road form stakes.

Standard Blaw-Knox road forms and an old finisher were used. C. P. Ingram was superintendent for W. A. Wilson & Sons.

**Mudjacking Settled Concrete
 Pavement**

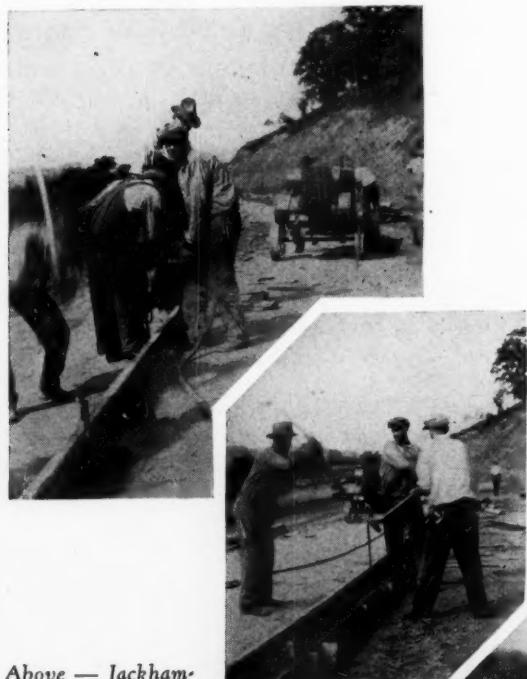
By Ray J. Marran

IN some sections of Kansas, slabs of concrete pavement which was constructed several years ago have sunk several inches, due to the settling of the sub-grade. These low slabs are being raised with the aid of a "mudjack," a machine which pumps soil under the concrete, raises it and rebuilds the subgrades at points where the depression appears. Until the invention of the mudjack by an engineer for the Iowa Highway Department, there had been no known method of raising a depressed section of a concrete highway.

The mudjack looks like a small concrete mixer without the discharge trough, the drum being connected with a pump. A few buckets of water are poured into the mixing drum of the machine and several shovels of soil from alongside the road are added. This is thoroughly mixed by the rotating drum into a thick mud.

Two-inch holes are bored through the depressed concrete slabs about six feet apart in all directions. A two-inch hose which is attached to the pump on the mudjack carries a nozzle which is placed in these holes, and the pump is started, forcing the mud under the concrete pavement. Almost at once the concrete slab begins to move upward. By pumping mud at the same rate into each hole the slab rises slowly without cracking. A slab 18 feet wide and with a depressed section 10 feet long can be raised with the mudjack to its original level in about sixty minutes, it has been found.

When the slab has been raised to the proper level



Above — Jackhammers brick to place spikes. Center — Four-story forms for 14-inch paving. Right — a general view of the work.



the holes are filled with a tar mixture and the job is completed. The mud dries under the slab, forming a solid subgrade said to be firmer than the original dirt.

The Iowa experience referred to by Mr. Marran was described by W. H. Root, maintenance engineer, Iowa State Highway Department, in a paper before the annual conference on highway engineering at the University of Michigan, from which the following is abstracted:

During the 1930 season Iowa had in operation five mud pumps developed for this purpose and known as the Poulter mud pump, with which 200 settlements, totaling 9292 lineal feet, were raised from 3 inches to a maximum of 13 inches. These used an average of 9½ cubic yards of filling material. As described below, cement is mixed with the soil, 2299 sacks have been used last year. The total cost of material was \$1,580, of labor \$8,329, and rental of equipment \$8,987. A total of 18,584 square yards was raised, giving an average total cost of \$1.02 per square yard, or \$9.88 per cubic yard of material pumped.

The procedure followed last year, and the equipment used, may be described briefly as follows:

The equipment consists of a hopper for receiving earth, water and cement; a mixing chamber for mixing the materials; a receiving chamber for holding the mud and delivering it to the pumps; a 2-cylinder reciprocating pump powered by a 20 h.p. gasoline engine; outlet hose; and power plant.

In raising a slab, a cut 4 in. wide is made across the pavement at one end of the settlement to prevent binding when the slab is raised. Then 2½-in. holes are drilled through the slab, spaced 4 to 10 feet apart, some near the edge and some near the center joint; a compressed-air jackhammer being used for this purpose. The filling material is then placed in the hopper together with water and mixed to a soft grout containing about 45 percent moisture and passed to the cylinders of the pump, which forces it through a high pressure 2½-inch fire hose reduced at the outlet to a 2-inch steam hose. The last has some elasticity and, when entered into a 2½-inch hole, expands under the pump pressure so as to fit it tightly. Rather high pressure is needed to break the bond of the slab to the sub-base, in some cases reaching 50 lb. per sq. in., after which a pressure of less than a pound is required to raise it to position.

As filling material, black top soil and loess have been found most satisfactory. Sand wears the cylinders too rapidly, gravelly soil clogs the valves, and heavy clay does not readily form grout of the desired consistency.

It was found that, under certain conditions, the mud pumped into one hole escaped through the others or under the edge of the slab. By waiting for an hour or two the mud would stiffen sufficiently to prevent this; but it was found that by adding 1 part cement to 20 parts earth, this time could be reduced to 15 or 20 minutes. The setting up is not a typical cement action but the

effect is the same as a slight drying out of the mixture. Moreover, an earth grout without the cement was found to shrink about 10 percent, but with cement added, only 3½ percent. Before adopting this mixture, various proportions of lime, cement, and plaster of paris were tried, but the 1:20 portland cement was found the most satisfactory.

Mr. Root gave as the principal advantages of this method, that the work can be done quickly, is not expensive, does not require skilled labor, does not require detouring of traffic, comes nearer to curing the cause than any other method devised, and lends itself readily to additional raising if additional settlement takes place.

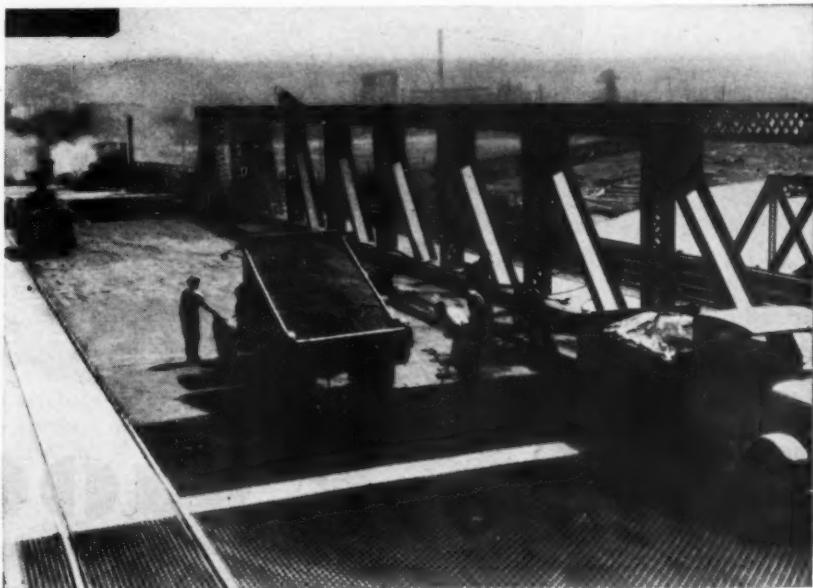
A New Steel-Asphalt Bridge Floor

A new type of floor pavement was used on the new West Spokane street double-leaf bascule bridge at Seattle—believed to be the first application of this type except for trial installations. It consists of a steel mesh, filled and covered with sheet asphalt.

The steel part of the pavement consists of a series of straight bars 1¼" x 3/16", riveted together with alternating reticuline or crimped bars 1¼" x 3/16", forming an open mesh mat. This is fabricated in sections, and by means of an interlocking splice is assembled in the field to form a continuous pavement over the entire area. It is fastened through clips by means of 5/16x3" drive screws driven into the creosoted wood deck through a layer of galvanized sheet iron, which was introduced to protect the asphalt from any possible chemical action from the creosote.

To give a better traffic surface and protect the steel from corrosion, it was filled with sheet asphalt. The asphalt was spread and rolled, after which a heavy truck loaded with sand and equipped with wide, solid rubber tires was run back and forth while the fill was still warm, thus giving a slight cupping in the meshes.

This installation was made under the specifications of the City Engineering Department and under the direct supervision of the Bridge Department of the City of Seattle, Washington. It was installed by the General Construction Company of Seattle, Wash., and made by Irving Iron Works Company, Long Island City, New York.



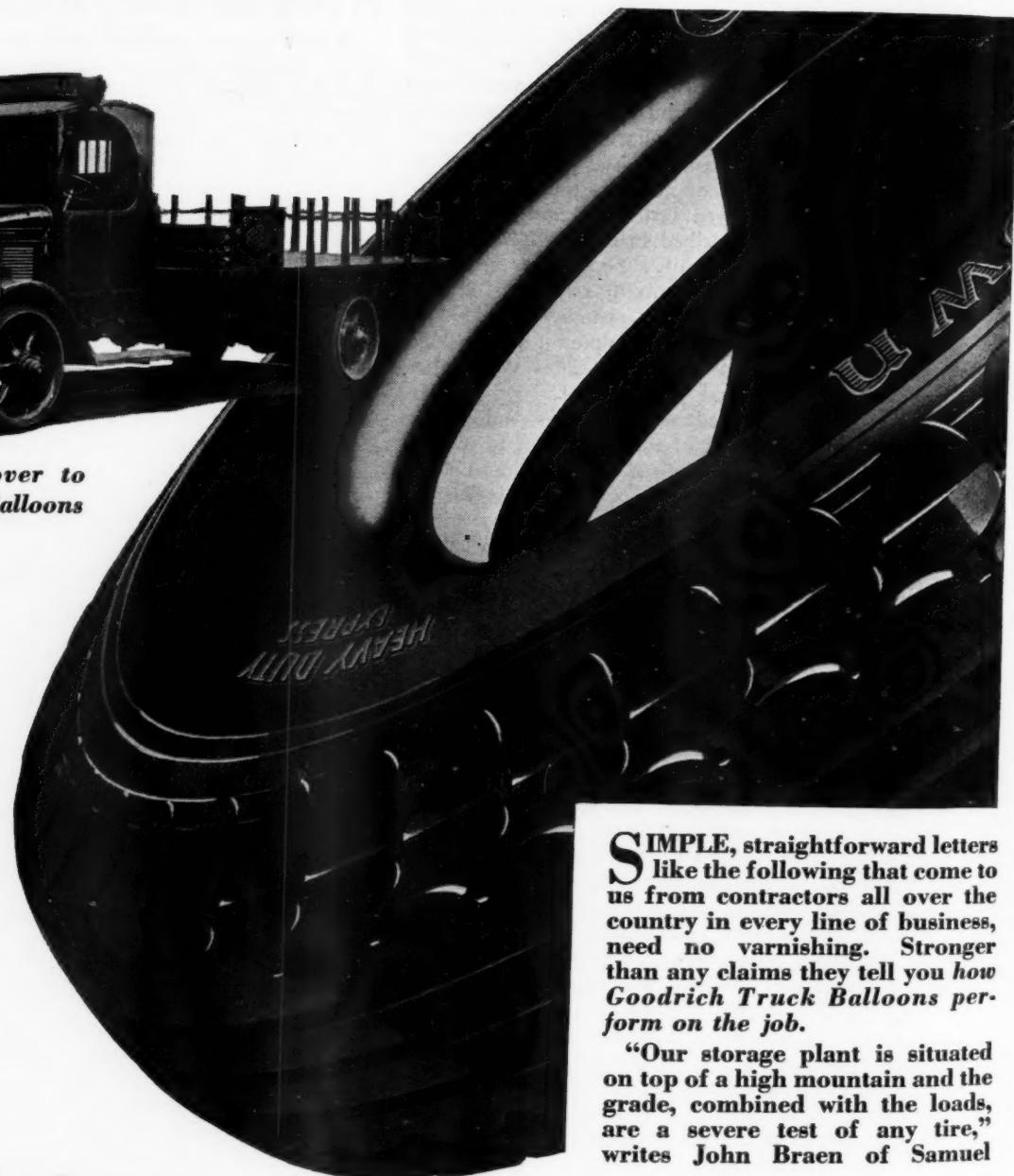
Laying new type of bridge floor pavement.

On Any Job...

this simple **CHANGE-OVER** brings



*Before change-over to
Goodrich Truck Balloons*



SIMPLE, straightforward letters like the following that come to us from contractors all over the country in every line of business, need no varnishing. Stronger than any claims they tell you *how Goodrich Truck Balloons perform on the job*.

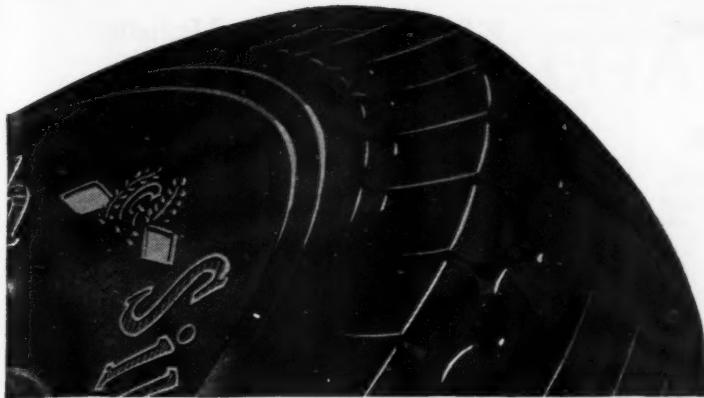
"Our storage plant is situated on top of a high mountain and the grade, combined with the loads, are a severe test of any tire," writes John Braen of Samuel



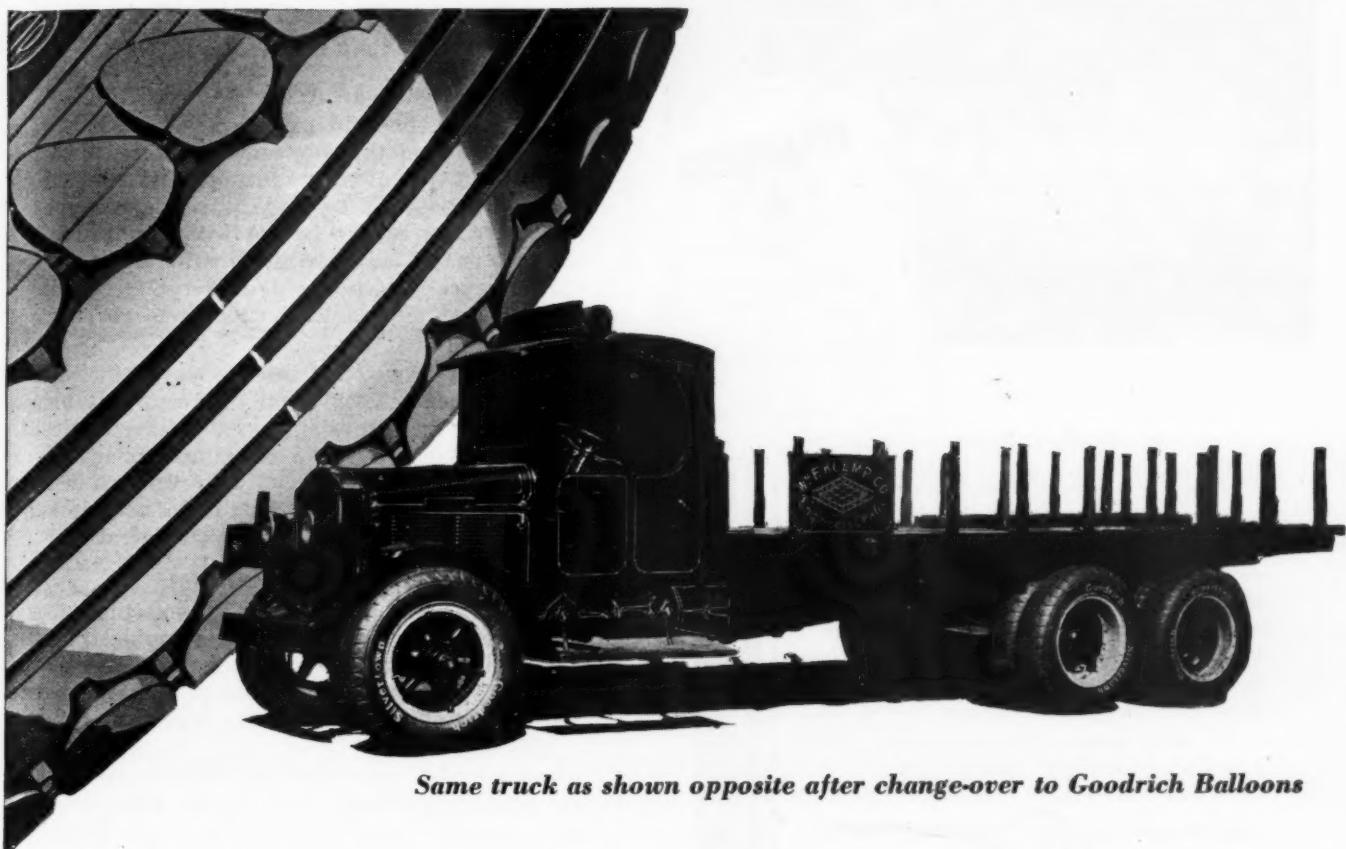
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32,000 Rubber Articles



NEW TRUCK PERFORMANCE



Same truck as shown opposite after change-over to Goodrich Balloons

Braen's Sons, General Contractors, Hawthorne, N. J. "The hauls are long and short over good roads and bad, but Goodrich Truck Balloons have met this test and proved much more satisfactory than our previous tire equipment."

"Silvertown Truck Balloons have reduced mechanical maintenance, give more traction, and considerable more mileage on our fleet of twenty-five dump trucks,"

writes A. E. Biggs, Washington, D. C. "I also find that drivers prefer to drive a truck equipped with Silvertown Balloons."

"For years I was shopping around to get a tire that would stand the severe test to which I put them," says C. E. Noss, Mechanicsburg, Penn. "Goodrich Truck Balloons have met this test. They are delivering approximately twice the mileage of other makes under the same kind of

driving and road conditions."

For further information, phone your nearest Goodrich Distributor. Look under "Tires" in the classified directory.

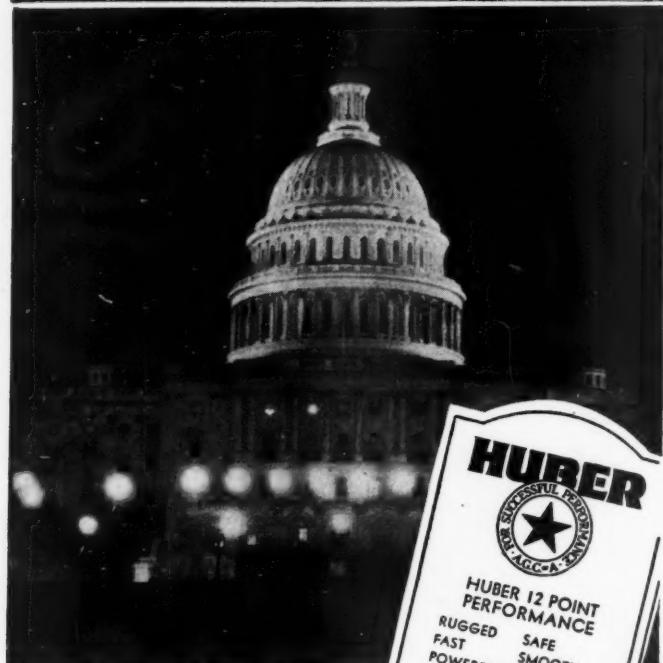
The B. F. Goodrich Rubber Company, Est. 1870, Akron, Ohio. Pacific Goodrich Rubber Co., Los Angeles, Cal. In Canada: Canadian Goodrich Co., Ltd., Kitchener, Ont. The International B. F. Goodrich Corp. (Export).

Truck Balloons

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For latest catalogs—consult the *classified* INDUSTRIAL LITERATURE section, beginning on page 83

SAFE

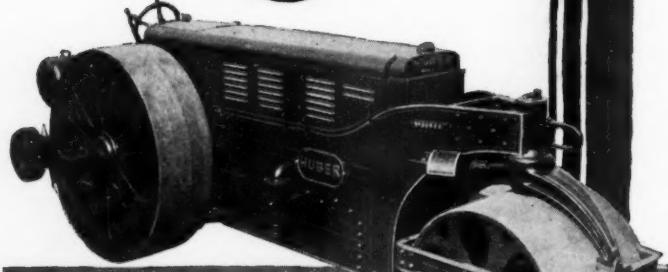


FOR THE ROADWORK of the NATION

HUBER'S ability to handle many types of road work makes it an extremely valuable and profitable piece of equipment to own. With Huber, one machine does the work of several, at but a fraction of the cost. Contractors, State Highway Departments, Cities, Counties, Townships, Municipalities—all are using and endorse Huber Motor Rollers.

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THE HUBER MFG. CO.
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HUBER MOTOR ROLLERS

When writing, please mention PUBLIC WORKS

Surface Treatment Methods

(Continued from page 18)

tar applied to half the width of the road at a time at the rate of $\frac{1}{4}$ gallon per square yard. The pea gravel was then applied from a spreader on a truck at the rate of about 25 pounds per square yard and rolled in with a 10-ton roller; traffic being maintained.—Richard K. Whitehead, Sr. Civil Engineer.

Delaware County, N. Y., surface treated 26 miles of bituminous macadam with asphalt and No. 1 crushed limestone at a cost of \$800 per mile. The width of treated surface was 12, 14 and 16 feet. Hvass stone spreaders, a Standard Oil distributor, dump trucks and steam and gas rollers were used.—W. J. Howland, County Sup't. of Highways.

Operating Motor Trucks Efficiently

(Continued from page 23)

Deciding Which Truck to Use

Fixed limitations in the job itself, or in the machinery used on the job, may sometimes determine the size and type of truck to be operated. In the case cited on the preceding page, for example, the fact that the mixer was to be fed with complete batches of sand, gravel, and cement forced the contractor to operate trucks which would deliver the materials in batches; and the two-batch truck was obviously the best type to use.

There are many other cases, however, in which the nature of the work leaves the contractor free to select the truck equipment to fit the job—either by deciding which of his own trucks to assign to it, or by deciding what kind of trucks to hire or buy. In such instances, the contractor has a definite need of a reliable method of basing his choice upon sound consideration.

The Cost Index Figure

Somewhat complex formulas are sometimes used by large operators who have complete engineering staffs. But for most practical purposes, the Cost Index Figure will give a fairly close estimate of the relative transportation cost between various types of equipment.

The Cost Index Figure is a coefficient or *indicator* of *comparative* operating cost. This indicator is found by comparing mileage, load, speed, and cost of operation on the trucks under consideration. The hauling cost per ton or unit is in direct proportion to the mileage to be covered and the operating cost per mile; but it is inversely proportional to the speed of the truck and the load carried. The following simple formula expresses the relationship of these factors and may be used to compare the relative hauling costs in terms of a cost index figure:

$$\text{Cost Index} = \frac{\text{Mileage} \times \text{Relative Cost of Operation in \%}}{\text{Load} \times \text{Speed}}$$

By applying this formula to each of two or more trucks, the contractor can readily determine which of the two will be the more profitable, and how much it will save on the hauling costs. A typical example is shown in the table (page 23). In this case, the contractor faced a choice of two trucks—both in his own fleet—for a fairly simple hauling job. Either truck was fully capable of handling the work. Either could move the steel promptly, as fast as it arrived. But a quick comparison, by means of the cost index formula, instantly revealed that the five-ton truck was by far the more economical one to use on the job.

RECENT LEGAL DECISIONS

By John Simpson

CONSTRUCTION

Workmen's Compensation—Testing Road Foreman's Automobile by Member of Crew

The foreman of a road crew employed by a county highway commission owned an automobile which he used in the work, the commission supplying gas and oil and paying for minor repairs. The foreman's son, a member of the crew, was killed by a train while testing the car after making repairs on it. It was held, *Columbia County Highway Commission v. Peterson*, Wisconsin Supreme Court, 230 N. W. 40, that his death occurred while performing services "growing out of and incidental to" his employment, and an award for workmen's compensation was affirmed.

The testing and repairing of machinery used in promoting the business of an employer is a service that is within the scope of the employment, regardless of the question whether the machine belongs to the employer or is merely used by it to transact its business.

Subcontract—Permission to Substitute Brick for Tile

A subcontract covering the brick and tile on a building provided that, if more than 280,000 common brick were required, the subcontractor should be paid \$36 per thousand for the excess of brick so laid. Hollow tile was specified for part of the work, but the subcontractor was permitted to use hollow brick instead. He substituted 7,500 hollow brick for tile; 24,000 brick in excess of the 280,000 were laid. It was held, *Headrick v. Martin*, Washington Supreme Court, 290 Pac. 994, that the 7,500 substituted brick were not an extra, and must be deducted from the 24,000 excess, since the subcontractor, if he had furnished the tile, would have been obliged to supply it at his own expense under the contract.

Road Subcontract Confined to Items Specified Therein

Where a general contractor splits up his contract into separate items and subcontracts those items, if he fails to subcontract and specify all the items included in the general contract, such items as he omits to specify in his subcontracts he must take care of himself. A mere reference to the general contract and the provision in the subcontract that the subcontractor is to be bound by the terms, plans and specifications of the general contract, cannot alter the terms or conditions of a subcontract, which, by its terms, is limited to certain definite and specific items—in this case the doing of only four selected and specific items at a specified unit price per unit of quantity. These items were, binder loading; loading, crushing and screening surfacing material; hauling surfacing material, and spreading and rolling surfacing material, in the construction of the specified portion of a highway. Under the terms of the subcontract, instructions in an action against the subcontractor and his surety should have been limited to these items. *Inland Eng. & Construction Co. v. Maryland Cas. Co.*, Utah Supreme Court, 290 Pac. 367.

SEWERAGE

Disposal of City's Sewage by Borough's Disposal Plant

Where a borough agreed for a cash payment to receive into its trunk sewer and dispose of by its disposal plant part of the sewage from a city, it was held that a taxpayer who, with knowledge of the contract and of the borough's use of the money, part of which was spent for improvements on the plant, had stood by for seven years without attempting to review the contract or the ordinance authorizing it, could not, because of laches, challenge the validity of the contract. *Groth v. Borough of Maywood*, New Jersey Supreme Court, 151 Atl. 59.

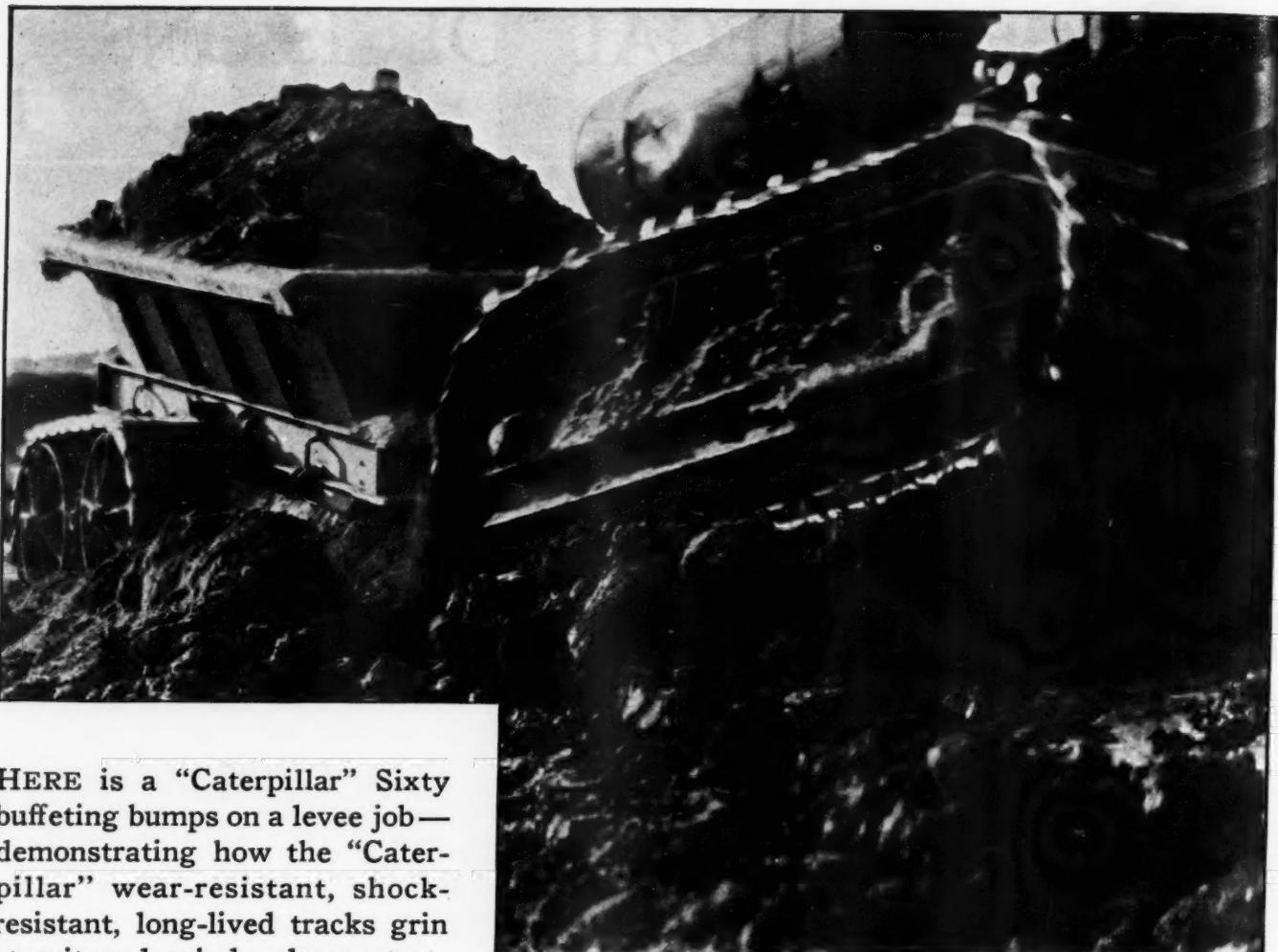
Compensation for Sheetin Left in Sewer Trench

Contractors for a municipal improvement are not generally entitled to interest on compensation during the time the city, acting in good faith in strict compliance with the contract, temporarily withholds payments as indemnity for damages resulting from the work of construction. *Petersen v. City of Omaha*, Nebraska Supreme Court, 231 N. W. 763. But, as a general rule, stipulated compensation for work and materials furnished by contractors in performing their contract for a municipal improvement draws interest from the time payment is due thereunder and unpaid, in the absence of an agreement to the contrary, where the delay is unreasonable and the amount for which the city is in default is liquidated or definitely ascertainable.

In a sewer construction contract, provisions disallowing extra compensation for sheeting left in the trench and including payment therefor in the price for constructing the sewer by the lineal foot, and other provisions requiring payment for sheeting left permanently in the trench by order of the city engineer, were held reconcilable by a construction applying the first provision to lumber voluntarily left in the trench by the contractors and the second to lumber left there by order of the city engineer.

Proof of Proper Performance of Sewer Contract

In an action for the balance due on a sewer construction contract, the city defended on the ground that the work was not properly done, or that defective sewer pipe was used. The city proved that about a year after completion of the contract the main sewers on two streets were cracked or broken and filled up with sand; and that there were faulty connections with the offsets that led to the houses. The city's consulting engineer, who supervised the work, testified that in his opinion, if the pipes had been up to specification and the work properly done, the sewers would have been in perfect condition. On cross-examination he stated that the foundations were good, but that it was possible that the condition found might have been brought about by a lack of side drainage or by high tides entering them from the river. There was no proof that the side drainage was insufficient or that the sewers had been affected by high tides. The Circuit Court of Appeals, Fifth Circuit, City of Manatee v. Gedney & Sons, 41 Fed. (2d) 516, held that enough evidence had been tendered by the city



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to make the question whether the work was not properly done or defective pipe used one for the jury, so that it was error to withdraw the case from the jury.

Liability for Cost of Unauthorized Sewers Accepted and Used

Under North Carolina Comp. St., §§ 2830, 2831, 2881, providing that the board of commissioners of a city shall make or authorize the making of all contracts, and that no contracts shall be binding unless made by ordinance or resolution or reduced to writing and approved by the board or expressly authorized by ordinance or resolution, the North Carolina Supreme Court holds, Abbott Realty Co. v. City of Charlotte, 198 N. C. 564, 152 S. E. 686, that a contract whereby the commissioner of public works authorized a lot owner to have sewers constructed, the city to reimburse the lot owner for the cost thereof as soon as it should have available funds, such contract not being expressly authorized by the board of commissioners, was not binding on the city. The statutory power conferred upon the board to make or authorize the making of contracts binding upon the city must be exercised by the board in strict conformity to statutory provisions. And a municipal corporation is not bound by the action of its governing body in ratifying a contract which such body had no power to make in the first instance, or which was made without compliance with mandatory statutory provisions as to the manner in which the contract shall be made.

But it was also held that the city would be liable for the reasonable and just value of the sewers if the jury should find that after their construction the city took them over and incorporated them into its municipal sewerage system. A judgment of nonsuit was therefore reversed.

Material Encountered in Sewerage Construction—Quicksand

A sewerage construction contract provided that if quicksand should be encountered in making excavations for the system, it should either be removed as extra work or that a special allowance should be made to cover the actual cost of labor and supplies, plus 15 per cent for overhead expenses. Quicksand was defined in the contract as consisting "of material in place, so saturated that cohesion is practically destroyed, which acts as a fluid and not as a granular or plastic mass, and is so retentive of its moisture that it cannot be drained without causing the material to flow," and which, when uncovered, would readily rise in the bottom of the trench. Claiming that quicksand had been encountered and that it be classified and paid for as such, the contractor, on the city's refusal to do so, sued to rescind the contract. There was testimony on both sides of the question as to whether the material encountered was quicksand. The Circuit Court of Appeals, Eighth Circuit, Kennedy v. City of White Bear Lake, 39 Fed. (2d) 608, held that the evidence was sufficient to support findings that the material encountered was not quicksand within the contract definition. Moreover, the contract provided that the engineers were "to decide all questions as to compliance or non-compliance with the specifications of the contract," and the court held that the engineers' refusal to make the classification urged by the plaintiff was alone conclusive. The court rejected the contention that the material encountered, if not in fact quicksand, should have an independent classification.

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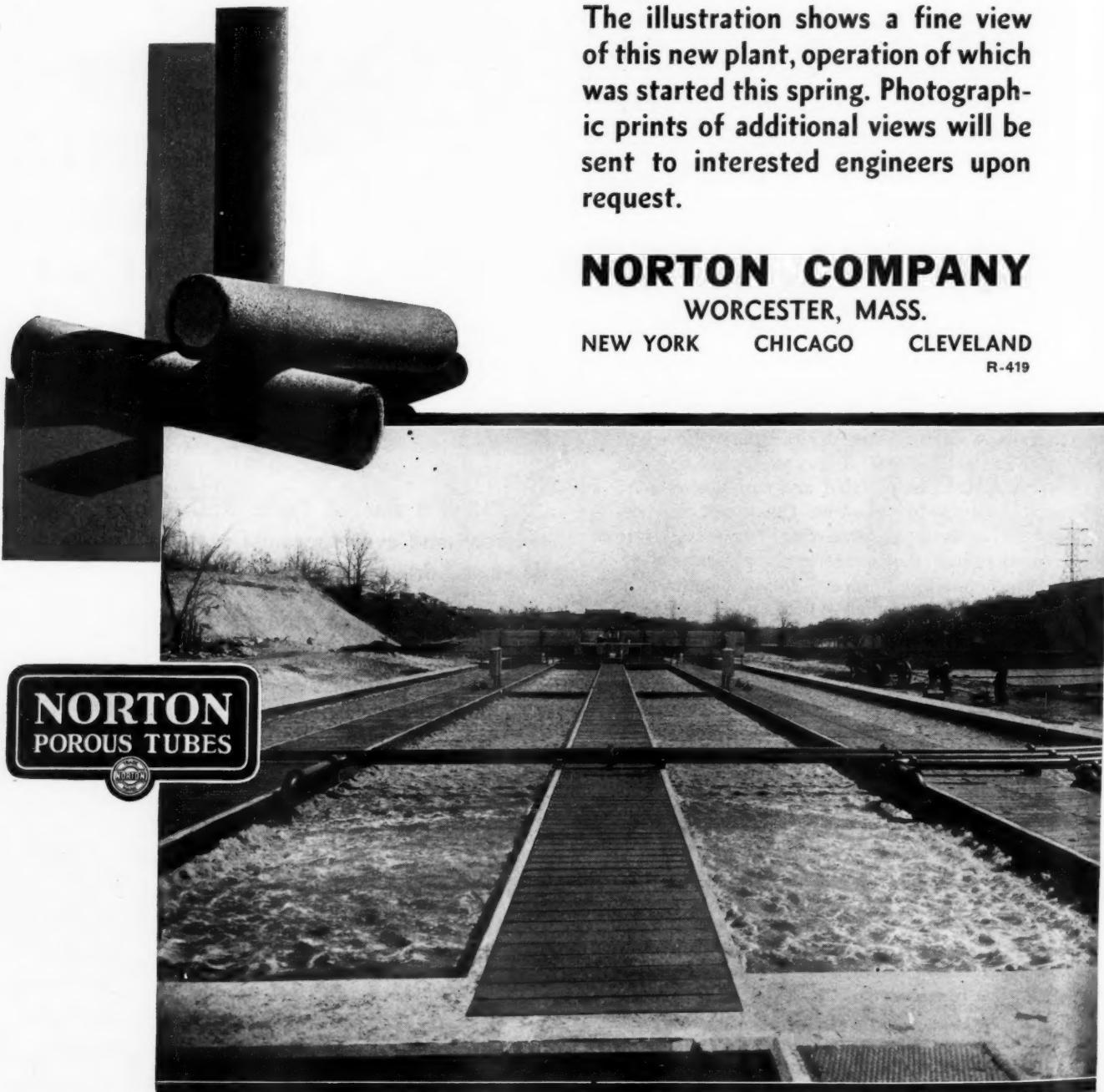
A Feature of This New Plant

THE diffusers in the new Woonsocket, Rhode Island, activated sludge sewage disposal plant are Norton Porous Tubes. They are 24" long with 3" bore and 5/8" wall thickness.

The illustration shows a fine view of this new plant, operation of which was started this spring. Photographic prints of additional views will be sent to interested engineers upon request.

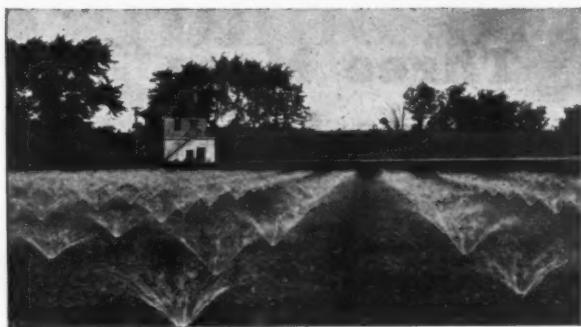
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Agreements for Receiving Trade Wastes in Sewers

The Shipley (England) Urban District placed in operation in March a reconstruction of a sewage treatment plant. During the reconstruction negotiations were carried through with all the manufacturers of the district, and the whole of the liquid trade wastes from their mills are now dealt with at the sewage works. The main points covered by these agreements are:

1. The agreement to be for a period of years, usually ten.
2. In the event of the works continuing to discharge liquid trade waste into the sewers after the expiration of this period, the terms to be subject to revision, and failing agreement to be settled by arbitration.
3. The firm to remove grit and coarse, solid matter to the satisfaction of the council.
4. The firm either to extract or not to extract grease from the effluent over the whole of the period of the agreement. That is, the manufacturer is not given the power to extract grease when the market is good and then turn the crude effluent into the sewers when the market is less favorable. This clause is a safeguard in case the council should at any time decide to install a grease-extraction plant.
5. The temperature of the effluent entering the council's sewers not to be higher than 150 deg. F.
6. The firm to provide and maintain all works, including pumps if necessary, to deliver the effluent at sufficient head into the council's sewers, such work to be carried out to the satisfaction of the council and to a plan approved by them.
7. Suitable provision to be made for the regulation of the flow at a uniform rate. (The strict observance of this clause has only been insisted upon in the case of spent gas liquor.)
8. Provisions for access to works for council's officers.
9. Arrangements for assessing flow. In a few cases the effluent itself is metered, but more often the flow is based on water consumption. In many cases the basis is 6/7 of the total water consumption.
10. The firm to pay at an agreed rate per 1,000 gallons of effluent discharged into the council's sewers. The charge is based in every case on the strength of the effluent to be treated.
11. Provision for a minimum annual payment, based on about two-thirds of the normal flow. This clause is to protect the council if the flow from the works should decrease considerably, and of course, only operates *in place of Clause 10* above.

12. Clause referring to recovery, disconnection and damages in default of payment.

13. The firm to stand the cost of preparing and stamping the agreement.

14. Usual arbitration clause.

This form of agreement has been found to serve excellently. The clause as to the removal of solids has only been enforced as far as is necessary to protect the sewers. The aim has been to reduce treatment at the mills to a minimum which will eliminate danger of nuisance from smell.

Explosive Gases in Manholes

A SURVEY extending over a year has recently been completed by the U. S. Bureau of Mines, in cooperation with the Edison Electric Illuminating Company, to determine the nature and amount of gas in street manholes in Boston. The survey was made as the result of several explosions in manholes, conduits and other underground openings which caused extensive loss of property and inconvenience to users of light and power. Conditions in Boston are similar to those prevalent in other large American cities, and if an explosion in an underground space should occur in a congested section, especially during a rush hour, enormous damage and loss of life might result, the Bureau points out.

During the survey 1,765 different manholes were tested and 4,068 tests made, state G. W. Jones and G. St. J. Perrott in a report just made public.

As a general average, 6 per cent of the manholes tested contained combustibles or sewer gas at one time or another. The majority of these were in the city of Boston; manholes in outlying districts were usually free from gas. Two districts in Boston had manholes in which the combustibles were above the upper explosive limit and represented especially dangerous conditions.

Carbon monoxide and hydrogen were present in all samples which contained combustibles in amount equal to 25 per cent of the lower explosive limit, on which complete analyses were made. In no case were gasoline or other similar hydrocarbons detected.

Sewer gas was found in 9 samples. The amount of combustibles was always so low in these as to present no explosion hazard, but on account of the low oxygen content, such atmospheres would suffocate workmen who entered them without respiratory protection.

The number of gassy manholes found during the different test periods declined steadily. This marked decrease in numbers as the survey progressed was

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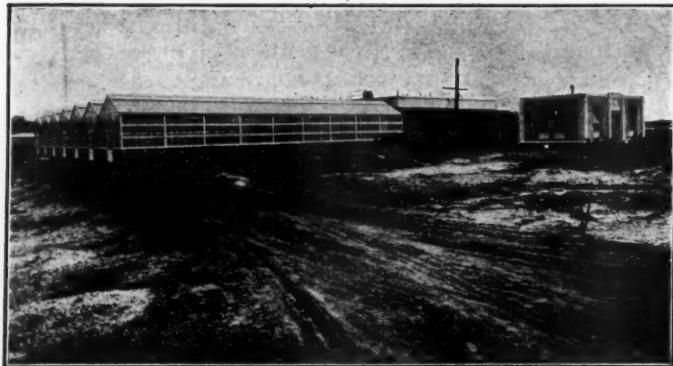
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largely due to the willing cooperation of those responsible for the presence of gas in the manholes.

A simple portable testing apparatus was developed by the Bureau of Mines which would indicate whether the manhole atmosphere was explosive, or above the upper explosive limit, or deficient in oxygen, or, if below the lower explosive limit, the approximate percentage of combustibles present.

The results obtained indicate that it would be well worth while for utilities in other cities to conduct similar tests over an extended period and to promote similar joint action to that which is to be carried out in the Boston territory during the year 1931 by The Edison Electric Illuminating Company of Boston and the Boston Consolidated Gas Company. Through this cooperation, a joint test crew will continue to operate, and in conjunction with the Bureau of Mines a report is to be expected for the calendar year 1931.

Further details are given in Report of Investigations 3109, copies of which may be obtained from the United States Bureau of Mines, Department of Commerce, Washington, D. C.

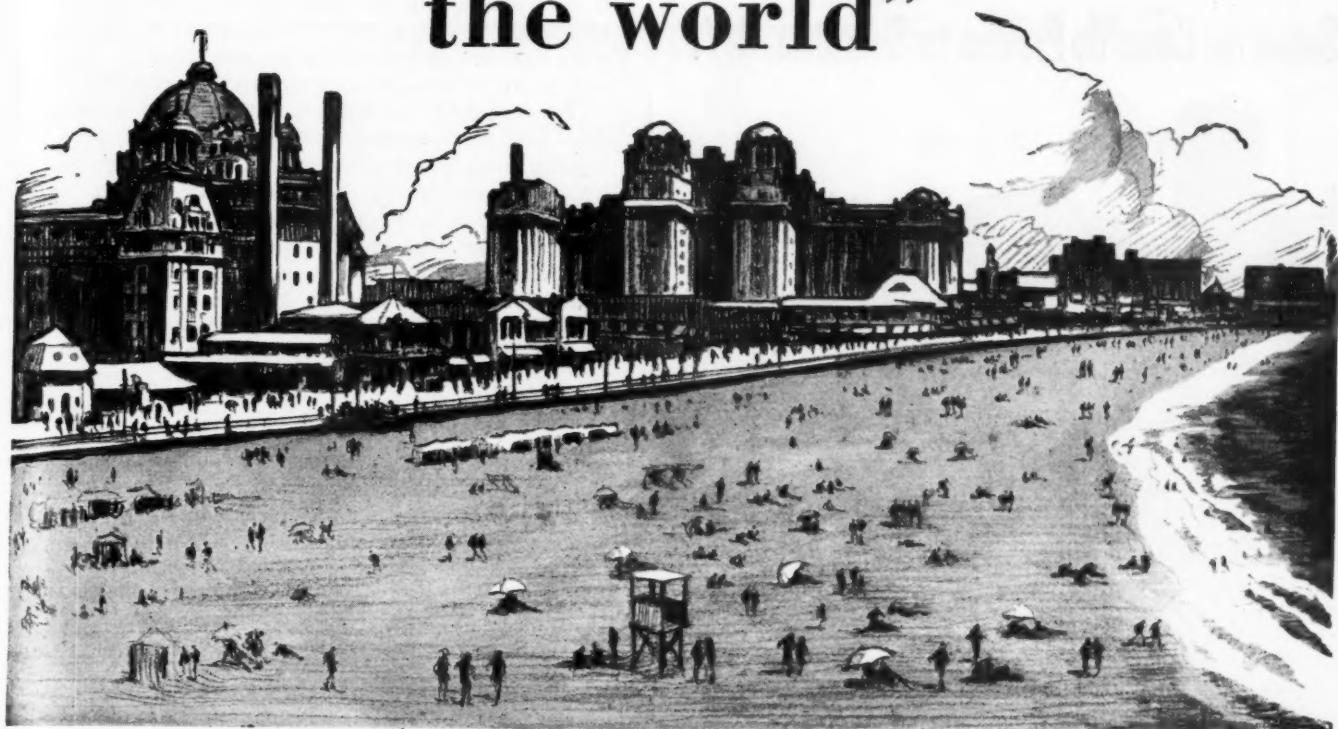
Algae Growth in River Due to Sewage Plant Effluent

Stream pollution is one of the important subjects studied by the Maryland Bureau of Sanitary Engineering, Abel Wolman, chief engineer. In the report for 1930 the board discusses as follows interesting conditions found below the outlet of Baltimore's sewage treatment plant:

The Clathrocystis and Coleosphaerium types of algae growth were exceedingly prolific in Back river in the vicinity of the outfall of Baltimore City's sewage disposal plant, despite a great effort on the part of the city to retard the growth by systematic applications of copper sulphate.

The algae growth in this section of Back river probably presents one of the most difficult stream pollution problems in the State. Paradoxical as it may seem, the production of a highly purified sewage from Baltimore's sewage disposal plant provides the active stimulus to growth. For the past few years much study has been given to this problem. During the past year a carefully planned system of copper sulphate treatment failed to retard the growth. The cooperative work of the city and state was supplemented by an investigation by Dr. W. C. Purdy, planktonologist of the U. S. Public Health Service, invited to review the situation in the field by the State Department of Health. Dr. Purdy concluded that the abundant blue-green algal growth was largely a result of the discharge into Back river of 60 million gallons daily of the highly nitrified sewage effluent from Baltimore's sewage treatment plant. This sewage effluent carries into Back river large quantities of carbon dioxide and nitrogen compounds, particularly nitrates, both highly encouraging to heavy algal growth. The elimination of the treated effluent from Back river would probably constitute an effective remedy for the algal growth. Such a remedy, however, would involve the extension, at great expense, of the outfall line to a point below the mouth of Back river. Because of the large expenditure necessary this remedy seemed undesirable. The

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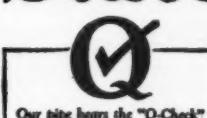
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Other cities in all parts of the country are aware of the efficiency and economy of deLavaud pipe. Springfield, Mass., Detroit, Michigan; Ft. Worth, Texas have purchased many miles of deLavaud Pipe for underground mains.

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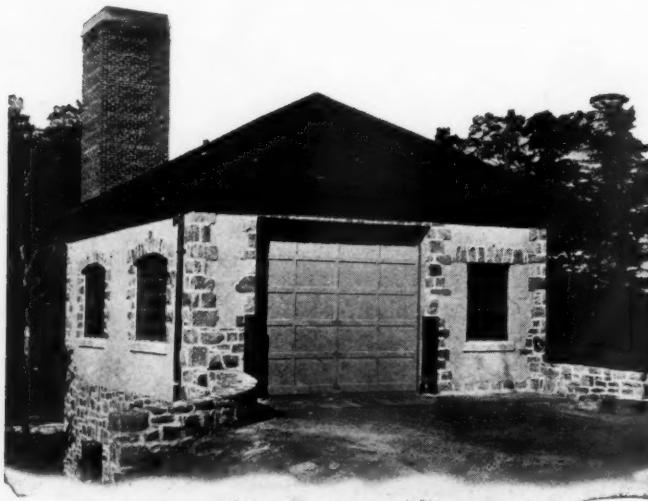
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periodic use of algicides upon the algae-bearing water was suggested as a possible remedy, but not strongly advocated for the present due to the difficulties experienced in dosing approximately 4 or 5 square miles of the river, whose depth averages from 3 to 6 feet, with a tide of from 1½ to 2 feet and a flood or ebb tide every 6 hours. Treatment of the effluent with chlorine to reduce the organic load in the effluent is to be inaugurated on an experimental scale.

Treatment of the effluent with lime to remove the free and half bound carbon dioxide, to check the algal growth in the river, seemed to offer a promising attack. Accordingly extensive experimental work was conducted by the city under Dr. Purdy's direction to determine the effect upon this type of algae of removing carbon dioxide and bicarbonates from the plant effluent by treatment with lime. Results of the experiments, however, showed conclusively that the dissolved organic matter, together with the high content of nitrates, in the sewage plant effluent provide sufficient suitable nutrient for bacteria, which is converted continuously by the latter into carbon dioxide and other substances of food value to plankton. This free carbon dioxide is not only available for immediate use by the algae, but its presence in excess immediately reverses the reaction obtained by lime upon free carbon dioxide and bicarbonates to produce more carbon dioxide and bicarbonates. Carbon dioxide is likewise continuously absorbed from the air, so that the removal of the carbon dioxide and bicarbonates without destruction of bacteria or exclusion of dissolved organic matter and nitrates, is futile for retarding the growth of algae or other chlorophyll bearing organisms.

The experiments of Sahib Raju in India, published in the Indian Journal of Medical Research, 11: 1057, (1924) show success in the destruction of algal growth by applications of sulphuric acid to destroy carbon dioxide and bicarbonates. This agent effects a simultaneous toxic destruction of bacteria. Dr. Purdy suggests that experimental work be continued, using sulphuric acid as an algicide. A continuation of experimental post-chlorination of sewage at the disposal plant and further trial of the toxic remedies by direct application to the river of various known algicides, such as copper sulphate and chlorine, are additional recommendations appearing in Dr. Purdy's report.

South Greensboro Sewage Treatment Plant

(Continued from page 36)

each of the end walls to a central discharge channel, which is enclosed for its entire length with a concrete structure, which serves the dual purpose of an inspection gallery and support for the main distributor of the distribution system.

Inspection galleries along the division and end walls are reached by open manholes cut out of the gallery.

A "Metro" block floor was placed over the concrete floor, with the channel blocks extending into the inspection galleries for ventilation purposes and accessibility for flushing.

The filter stone has a total depth of 7 feet, the bottom 12 inches having the following average analysis:

Retained on a 4 inch circular screen.....	1.13%
Passing 4 " and retained on a 2½" circ. screen	87.96%
Passing 2½" and retained on a 2 " circ. screen	5.71%
Passing 2 " and retained on a 1½" circ. screen	2.28%
Passing 1½" and retained on a 1 " circ. screen	2.58%
Passing 1 " circular screen.....	0.27%

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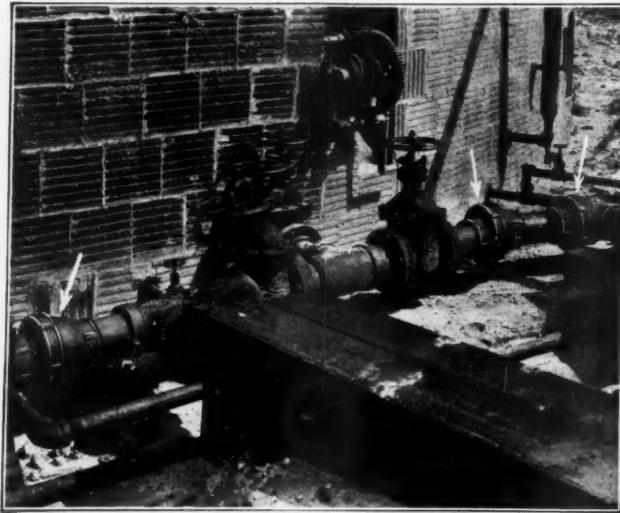


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The remaining 6 foot depth of stone has the following average analysis:

Retained on $2\frac{1}{2}$ " drain circular screen.....	7.84%
Passing $2\frac{1}{2}$ " and retained on 2 "	53.16%
Passing 2 " and retained on $1\frac{1}{2}$ ".....	25.02%
Passing $1\frac{1}{2}$ " and retained on 1 "	13.90%
Passing 1 "	0.89%

The filter stone was secured locally and is of two types. That used primarily gave the following analysis:

Loss on ignition, 0.24%; Moisture, 0.52; Silica and insolubles, 72.27; Phosphorous pentoxide, 0.13; Iron oxide, 2.80; Aluminum oxide, 14.77; Calcium oxide, 2.83; Magnesium oxide, 0.81; Potassium as sodium oxide, 4.79; Undetermined, 0.84; Specific gravity, 2.70; % Wear (Deval), 3.32; French coeff. of wear, 12.00; Hardness (Dony), 19.10; Adsorption, 0.33; Sodium sulphate, soundness test, Satisfactory; Toughness, 12.70.

The initial stone was placed by hand to insure covering of the grill blocks with the larger stone and prevent falling of the smaller stone into the grill blocks channels. The full 12-inch depth of coarse stone was then placed, using side dump cars and industrial tracks, the trucks delivering the stone to a storage hopper, which enabled rescreening of the stone prior to placing. The same method was followed in placing of the stone above the distribution system. The remaining stone was placed direct in the bed from trucks dumping on a portable inclined screen.

Each of the filters has an independent dosing tank and distribution system. The main distributor of 24-inch cast-iron pipe extends the full length of the bed, with 6 and 4-inch lateral distributors. Nozzle ties of the Marley type are staggered on the laterals so as to place the $\frac{1}{8}$ -inch Type C. Taylor nozzle at the apices of an equilateral triangle with sides 11 feet, $8\frac{1}{8}$ inches long and operating under a maximum head of 7 feet, 6 inches.

The filter effluent discharges into a 20-inch cast-iron pipe line and may be diverted to the secondary sedimentation tank or direct to the creek without further treatment. For purposes of flooding of either bed, a 20-inch sluice gate is provided at the outlet of each bed to the effluent pipe.

Secondary Sedimentation Tanks—The secondary sedimentation tank is similar to the primary sedimentation tank except that it is 50 feet square and 9 feet deep at the side wall. A sludge pump enables pumping the sludge to the digestion tank or returning it to the incoming sewage; and also is used to dewater the grit chambers for inspection or repair purposes.

Cost of Interceptor and Plant

Cost of interceptor, including right of ways and engineering	\$55,085.92
Cost of plant, complete	350,597.81
Plant land, engineering and interest on construction	46,421.69
Total costs	\$452,105.42

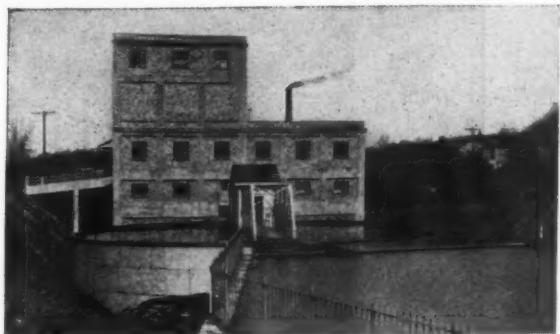
The interceptor and treatment plant were designed and constructed under the supervision of the writer as superintendent of the Water and Sewer Department, with W. M. Lybrook, Jr., in direct charge as resident engineer. R. R. King, Jr., is mayor and I. C. Brower is city manager. The contractors employed on the work were: Tucker and Laxton, Charlotte, N. C., general contract; Dorr Co., and Link Belt Co., equipment; Yeomans Brothers, sewage and sludge pumps; Charlotte Electric Repair Co., electric wiring; C. R. Sutton, Greensboro, N. C., filter stone; Westinghouse Elect. and Mfg. Co., motors and controls.

Details and Design Data On

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Water Consumption at Summer Resorts

The probable future water consumption of a community is one of the most important fundamental factors involved in designing a water supply system, and one least possible of mathematical calculation. Estimates are commonly based on past population growth and per capita consumption of the community in question and also of others assumed to be subject to like laws of development.

Perhaps the most difficult to estimate for and apparently the most erratic are seasonal resorts—winter or summer. Another difficulty in connection with designing plants for these is the wide difference between winter and summer population, one being two to four or five times the other. If pumping or purification is necessary, the plant must be made unusually flexible by subdivision into several units or else operated far below capacity for eight or more months of the year.

Careful estimating of capacity for such plants is therefore even more difficult than in the case of communities not subject to such seasonal fluctuations; and data on the subject are of great interest. Such will be found in the report for 1930 of the New Jersey State Water Policy Commission. This report gives the average annual consumption and that for the maximum month for each of 40 seashore resorts for the fourteen years 1917 to 1930 inclusive.

The average of all these shows the consumption during the maximum month to exceed the average for the year by from 49 to 75 per cent. If we assume the summer season to average three months' duration, the excess of the monthly summer average over the monthly winter average would be one-third greater, or from 65 to 100 per cent.

If single communities be considered, the difference is of course greater. Of the 40 communities, 16 reported the maximum monthly consumption more than double the annual average in 1930; and 16 (but not the same 16) in 1917. Five reported more than three times the annual average and one more than four times. If we consider several years a still greater difference is noted. Taking only the five years 1926 to 1930 inclusive, one company reports a factor of 17, another 27, another 31. Comparing the averages for the forty plants, the greatest maximum month during that five year period was more than double the smallest annual average.

Considering the averages of the forty plants for each year since 1917, we find the maximum month to exceed the average winter month (calculated as

above) by 100 percent in 1917, 85 percent in 1918, and 80 percent, 74 percent, 83 percent, 72 percent, 88 percent, 88 percent, 88 percent, 65 percent, 86 percent, 76 percent, 97 percent, and 97 percent during the succeeding years.

Maryland Water Works Studies

Excerpts from the annual report of the Bureau of Sanitary Engineering, Maryland State Department of Health, Abel Wolman, Chief Engineer.

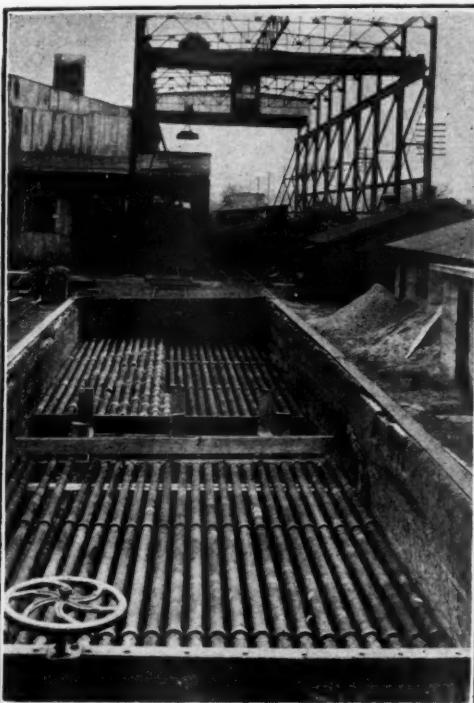
Guniting to Waterproof Reservoir

THE Bureau was authorized by the authorities at Rosewood State Training School to proceed with the construction of a 1,000,000-gallon earth embankment storage reservoir and pump house adjacent to Gwynns Falls, plans for which were prepared several years ago. The contract was let in the fall of the year at a price of \$7,739. It was planned to line the sides and bottom of the structure with rip-rap. During the excavation, however, a disintegrated mica schist was encountered, which indicated that a water-tight structure could not be obtained with the rip-rap lining. It was decided to gunite the inside of the reservoir, and a contract therefor was awarded to the Cement Gun Company at a price of \$3,470. Under this arrangement the institution furnishes all materials, including sand, cement and reinforcing steel. The work was started the latter part of the year and has not yet been completed.

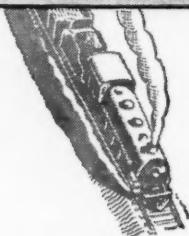
Studies of Corrosion of Mains

For the past few years regular examinations of the Salisbury, Overlook, Linthicum Heights and Glenburnie water supplies have been made for the purpose of determining the extent of internal corrosion of distributing mains and service lines. This Bureau has conducted several studies every year to determine the efficiency of controlling such internal corrosion by aeration and application of lime by measurements of free carbon dioxide, dissolved oxygen, caustic and total alkalinity and pH value at a number of points on the distribution system. This year the Hagerstown supply was similarly examined.

In addition to extending the information already accumulated upon the subject of internal corrosion of water supply mains, our studies this year materially strengthen the assumption that reductions in dissolved oxygen content of the water occurring at points on the distribution system are indicative of active corrosion. It has been found furthermore that a water adjusted to a minimum of aggressiveness for wrought and cast iron invariably shows active cor-



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rosion on the cheaper steel pipes found in many service lines and domestic plumbing. This latter finding has likewise revealed the absence of provisions in local plumbing codes to control the quality of piping in these parts of the distribution system. The cities of Hagerstown and Salisbury and the Anne Arundel County Sanitary Commission now have under consideration corrective clauses to be added to their local plumbing codes.

Chlorinated Copperas for Annapolis' Supply

As a result of the protracted drought of this year, Annapolis has supplemented its surface water supply with ground water from a 250 foot well of the Layne-Atlantic type. This Bureau was requested to prescribe methods of treatment suitable for each of these waters, as well as for a mixture of the two. The well water requires the removal of about 7 parts per million of iron, and the surface supply the removal of varying amounts of turbidity. The treatment, based upon laboratory tests, recommended for each supply, as well as for mixtures of the two, consists of pre-chlorination, treatment with chlorinated copperas, filtration and pH adjustment after filtration.

. . . Ferric chloride, the oldest of coagulants in the purification of water, was found to be slightly superior to alum as a coagulant for the ground water supply. However, due to the difficulty in handling this chemical, the cost of ferric chloride is now two to three times that of chlorinated copperas. Studies now under way may develop more practical methods of transporting and handling ferric chloride. Its use on this particular water supply, if more economical, would eliminate the chlorinated copperas unit, which is a chemical manufacturing unit requiring no small amount of attention.

Ammonia and Chlorine for Combating Tastes and Odors

During the year several of the larger water treatment plants of the State have been more or less successful in combating the usual seasonal tastes and odors peculiar to surface water supplies. In the Washington Suburban Sanitary District, the Hyattsville and Burnt Mills supplies have been treated with partial success by the application of ammonia in the mixing chamber before coagulation and chlorination after filtration. The interval between ammonia and chlorine applications was one hour. Experimental work is being conducted at these plants to determine the relative efficiencies of various points of application of both ammonia and chlorine.

At Hagerstown, success has been obtained by the similar application of ammonia and chlorine after filtration. At Baltimore, prechlorination with ammonia added at the same point in the mixing basin was successful. The detention before filtration was about 40 minutes. A residual of 0.1 part per million chlorine was maintained after filtration, thus requiring no post chlorination. The Bureau has suggested experiments with dry feeding activated charcoal prior to coagulation. This work will likely be conducted during the coming year at these plants.

The New Madrid Floodway

(Continued from page 28)

Tractors and Crawler Wagons and Small Draglines

J. C. Johnston Constr. Co. has the contract for piece 4-C, involving 2,153,000 yards at 25 cents. Most of the work so far has been done by tractors and crawler wagons and trucks and small draglines, though the contractor has been experimenting with an

improvised tower machine and slack-line cableway. The two draglines are 1½-yard machines with 40 to 50-foot booms. They are used for loading the tractor wagons and for excavating the ditch section—on this section, the drainage ditch and the levee are side by side—and the tractors and wagons build up the levee section.

A Railway Unit, Draglines and Crawler Wagons

Contract 4-D, which was let to James G. Yeats Co., at 28.5 cents per yard, involves 2,169,000 cubic yards, of which about 1,300,000 yards were sublet to J. J. McCaughey Co. Yeats has been using industrial railway equipment with marked success. His equipment consists of two P & H draglines with 60-foot booms and 2½-yard buckets, one locomotive and two 12-yard Western standard-gauge cars. These operate on a straight-across shuttle track, and at each set-up about 50 feet of levee is built. In order to avoid loss of time, the track is laid ahead and a switch provided so that operation is continuous. The dirt is dumped into a pit about 6 feet deep, located at right angles to levee course, and is placed in the levee by one of the draglines, while the other one loads the cars. The haul is about 400 feet. With this equipment, Mr. Yeats has been moving around 70,000 yards a month or a little less.

On the subcontract, McCaughey has been using tractor and trailer outfits, reinforced with two Linn units, and two large draglines. The tractor and trailer equipment is the same as that described in a previous issue of PUBLIC WORKS. These have been loaded with a 1-yard Northwest Gas Shovel. The two big draglines are both 6-yard, one a Monighan and a Bucyrus. The tractor and trailer outfit was discontinued during the bad weather of the winter, and the Northwest employed to dress down the levee after the big draglines.

The general plan of work on the McCaughey contract has been to put up the base and river toe of the levee with the tractor wagons from the ditch section. The Bucyrus dragline then follows along, taking dirt from the extremity of the riverside borrow-pit, while the Monighan then finishes the levee section.

Draglines Exclusively

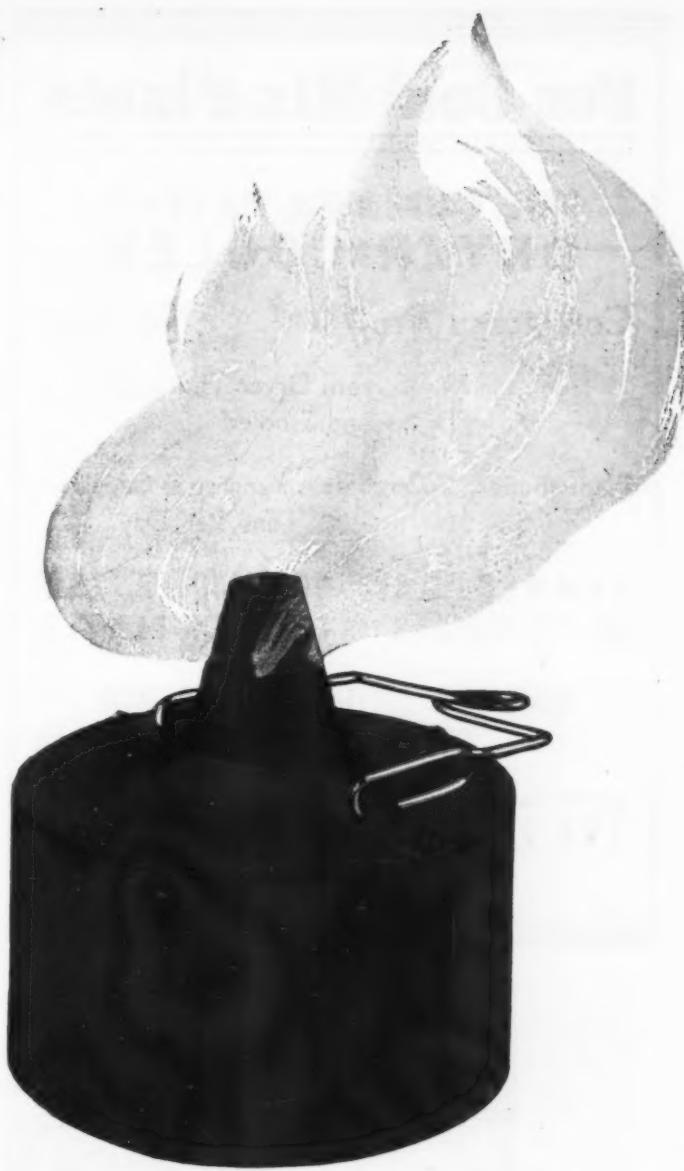
Draglines are used exclusively on the Boyce & Igo contract, 4-E, which involves 970,000 cubic yards at 36.75 cents a yard. On this job are the following: one 135-foot boom, 5-yard bucket, Monighan Diesel dragline; and two Monighan Diesel draglines with 70-foot booms and 3-yard buckets. In one 6-day stretch, the big Monighan placed 30,000 yards of dirt, and the monthly average has been around 135,000 yards. This job is now completed, or practically so.

Hydraulic Dredges

Willbanks & Pierce, who have contract 4-F, involving 1,975,000 yards at 32.47 cents per yard, are using the hydraulic fill method. Retaining levees are first thrown up on either side of the projected levee, and the hydraulic fill is pumped into the space between. These retaining levees are usually put up with side slopes of about 1:1. On this particular job a Northwest 1¾-yard dragline was used for the riverside retaining bank, and a P & H 2-yard machine on the land side.

The retaining levee on the land side is made from dirt taken from the drainage ditch; and the one on the river side from an enlarged muck ditch along the approximate center line of the levee.

Cross-check or cross levees are placed at intervals



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of 750 to 800 feet, thus limiting the length of pool and the amount of fine material that may collect at the end of the section.

After the hydraulic fill has settled and solidified, the draglines dress down the sides to the required slope. A landside borrow pit is provided in case additional material is required for topping out.

Trends in Street Pavement Construction

(Continued from page 30)

68.2 per cent in 1926, and 62.7 per cent in 1927. But, though the actual yardage of bituminous pavement laid decreased from 1928 to 1929, its ratio to the total pavement laid increased from 62.1 per cent in 1928 to 64.8 per cent in 1929."

Of all bituminous surfacing reported by these cities as laid during these five years, 56.6 per cent was sheet asphalt; 29.1 per cent consisted of asphaltic concrete, including stone-filled sheet asphalt, Warrenite-bitulithic, Amiesite, Topeka and Willite. Only 5 per cent was of asphaltic penetration macadam, 2.9 per cent was native rock asphalt, and 1.6 per cent asphalt block. The remaining 4.6 per cent comprised miscellaneous types, such as National, Besonite, Filbertine, etc.

Seventy per cent of all these bituminous pavements were laid east of the Mississippi river, and 88 per cent of this north of the Potomac and Ohio rivers. Comparing by size of city, the five Class A cities, which laid 30.0 per cent of all street pavement, put down 33.3 per cent of the total asphaltic pavement; the eight Class B cities laid 9.9 per cent of the total pavement and 9.2 per cent of the asphaltic pavement; the 24 Class C cities, which laid 17.1 per cent of the total pavement, put down 14.6 per cent of the asphaltic pavement; the 51 Class D cities, which laid 16.2 per cent of the total pavement, laid 17.1 per cent of the asphaltic; and the 113 Class E cities laid 25.7 per cent of the total pavement and 26.8 per cent of the bituminous.

During this five-year period, however, the use of bituminous compounds increased in the largest cities but decreased in the others; the yardage in the combined Class A and B cities increasing from 12,391,593 in 1925 to 15,206,069 in 1929; while in the C, D and E cities it decreased from 25,760,758 to 16,471,867.

The amount of *sheet asphalt* laid was less in 1929 than in 1925 in all sections of the country except the Pacific-Rocky Mountain, where it increased over 40 per cent and each year except 1928 showed an increase over the year before. It was 12 per cent greater in 1929 than in 1925 in the Class A cities, 25 per cent greater in the Class B cities; but 24 per cent less in Class C cities, 26 per cent less in Class D and 31 per cent less in Class E.

Laying of *asphaltic concrete* decreased in all cities, but least in the Pacific-Rocky Mountain states, and most (proportionately) in the North Central; the decrease in the former being only 2.3 per cent, but in the latter 65.8 per cent. The decrease for all cities combined was 16.4 per cent. Of the total laid during the period, 60 per cent was west of the Mississippi river and more than half of this in the Pacific-Rocky Mountain District.

The Class A cities laid only 13.5 per cent of all the asphaltic concrete pavements, and the Class B cities only 9.0 per cent; but the class C cities laid 21.6 per cent, the Class D 23.6 per cent, and the Class E 32.4 per cent.

The use of *asphaltic penetration macadam* on city streets is localized largely in the northeastern quarter of the United States, 85.5 per cent being north of the Potomac and Ohio rivers and east of the Mississippi river and Lake Michigan, chiefly in New England and Illinois; while most of the remainder is in Wisconsin. (This does not include non-urban highways.) The total laid increased 92 per cent from 1925 to 1929. It is largely a small-city pavement. Of the 2,586,820 sq. yds. laid in 1929, Class A cities laid 503,789, Class B cities 88,362, Class C cities none, Class D cities 868,316, and Class E cities 1,126,353, or nearly half of the total. The amount laid per year increased in each class except B.

Of the small amount of *asphalt block* laid 71.9 per cent was in Florida, and almost all the rest in New York and Ohio. New York was the only city of more than 100,000 population that uses it.

More *native rock asphalt* was laid in 1929 than in 1925 by 27.4 per cent. None was laid in the North-Central or Pacific-Rocky Mountain district. In the Southwestern the yardage increased from 696,594 in 1925 to 905,120 in 1929; in the Southeastern from 67,922 to 172,096, but decreased in the Northwestern from 88,209 to 9,564.

Portland Cement Concrete showed increased use in 1929 as compared to 1925 in every district except the North-Central, where it declined 15.1 per cent. The increase was 76.6 per cent in the Northeastern District, 12.8 per cent in the Southeastern, 42 per cent in the Southwestern, and 91.2 per cent in the Pacific-Rocky Mountain.

Sixty per cent was laid west of the Mississippi river and Lake Michigan, although only 35.8 per cent of all paving was laid there. Twenty-two cities of the Pacific-Rocky Mountain district laid 39.3 per cent of all the cement concrete laid by all the cities included in this report, although they contained only 10.6 per cent of the population; 27.4 per cent being laid by California. Only 7.0 per cent of the total was laid by the Southeastern district.

The amount laid in the Northeastern district was 76.5 per cent greater in 1929 than in 1925; in the Southeastern, 12.8 per cent; in the Southwestern, 42.0 per cent; in the Pacific-Rocky Mountain, 91.2 per cent; and decreased 15.1 per cent in the North-Central.

In 1925 Portland cement concrete constituted 19.1 per cent of the pavement laid by these 201 cities, but in 1929 it was 28.2 per cent.

Thirty per cent of the concrete pavement laid during this period was by Class A cities; 7.8 per cent by Class B cities; 22.0 per cent by Class C cities; 18.8 per cent by Class D cities, and 21.4 per cent by Class E.

Brick, block and stone are combined in these figures, and totaled only 10.8 per cent of all paving done in 1925 and 7.0 per cent in 1929. Only 6.4 per cent of the total was laid west of the Mississippi; 74.1 per cent was laid east of that river and north of the Potomac and Ohio rivers. Only about 0.1 of one per cent of the total was laid in the Pacific-Rocky Mountain district. The amount laid was less in 1929 than in 1925 in the Northeastern district, and much less in the Southeastern; but was 49.9 per cent greater in the Southwestern and 91.5 per cent greater in the North-Central.

These pavements were laid chiefly in the largest and smallest cities; 29.9 per cent of the total was laid by Class A cities (chiefly stone block in New

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York), and 30.2 by the Class E. Each of the other classes laid about 13 per cent. The amount of these classes of pavement laid was 32 per cent less in 1929 than in 1925.

Saranac Lake to Have New Sewerage System

A bond issue of \$125,000 has been authorized by the village board of Saranac Lake, N. Y., for the construction of sewers and a sewage treatment plant. All of the sewage of the community will be collected by an intercepting sewer and pumped to treatment works consisting of plain settling tanks, with continuous sludge removal equipment, separate sludge digestion tanks and open sludge drying beds. The effluent from the plant will be conveyed through an outfall sewer to the Saranac river.

Joint Municipal and Industrial Purchasing of Fire Pumper

By F. R. Buechner
City Manager, Gladstone Mich.

The fundamental principle—progress is born of co-operation, has been applied with marked success at Gladstone, Michigan, (population 5,500) with respect to fire protection, in the relation of government to industry.

For years the city's fire fighting equipment was wholly inadequate, consisting solely of an old Ford chassis with two 25-gallon chemical tanks mounted on it and a Republic truck equipped with fire hose and two 35-gallon chemical tanks. In the absence of a fire pumper, it was necessary to boost the water pressure at the pumping station from about 50 to 110 lb. pressure, obviously resulting in a great strain on the water distribution system and occasional bursting of hot water tanks.

Moreover, the industrial fire insurance rates, in specific cases, were above normal. And still worse, one or two plants, including residential sections, were remote from water mains and practically unprotected, though available surface waters could have been utilized, in the event of fire, by the possession and use of a fire pumper with suction hose.

City funds for the purchase of a \$6,500 triple combination Boyer fire pumper were available except for about \$2,500. In order to pay cash, in line with the city's pay-as-you-go policy, and to fulfill a long-felt need without raising the tax rate, the administration enlisted the support of the local industries.

The economic advantages and city's financial limitations were suggested in a letter to each of the heads of all the local industries. All of which responded 100%, on the first call, with checks ranging from \$100 to \$500 each.

The volunteer firemen's organization manifested their interest and loyalty by initiating the proposal for a pumper and, through their efforts, earned a fund of \$500 toward its acquisition.

With an allowance of \$700 on the city's old Ford chemical truck, the purchase of a pumper was consummated at a cash price of \$6,350 F.O.B., Gladstone, Michigan. In other words, the tax-payers, as such, paid \$3,950 from the current budget, for a modern combination chemical, hose and water pumper.

Aside from increased fire protection for all the people in general, and the industries in particular, this undertaking signally demonstrates the efficacy of joint effort in local government.

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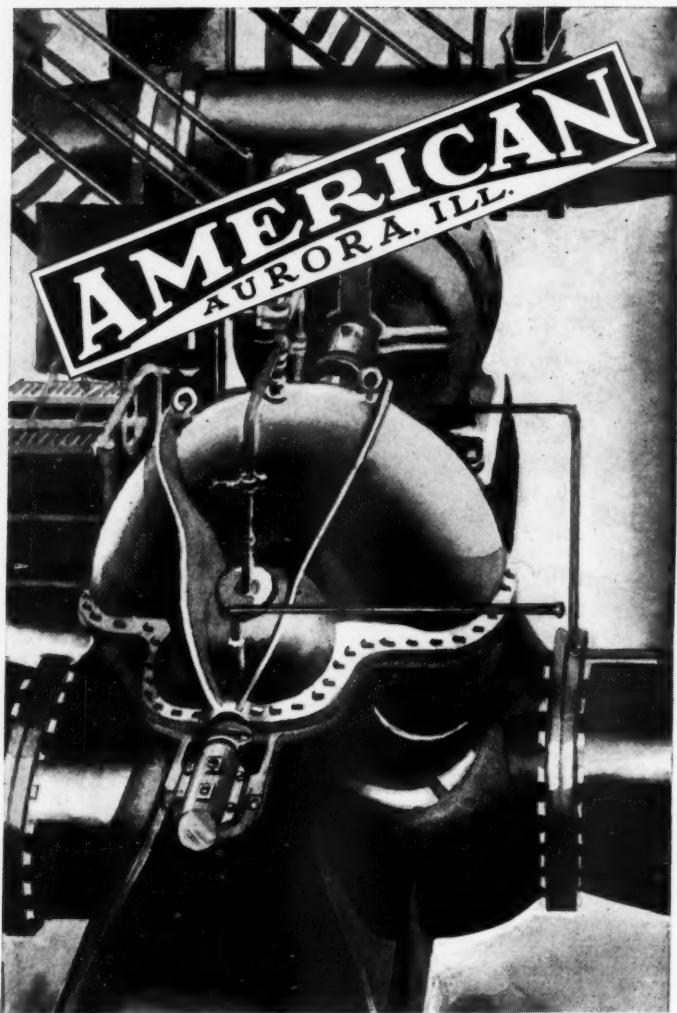
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THE AMERICAN WELL WORKS

General Offices AURORA, ILLINOIS and Factory

The Water Wheel

(Continued from page 40)

Health. Such replacement does not necessarily involve entirely new equipment for the ball may be replaced by a device which is controlled by a wrench, rather than merely forced out of the way to permit delivery of the water¹²³. A new manometer type flow gauge has also been developed to meet British conditions¹²⁴.

Embrittlement of boiler metal may be due to a number of factors¹⁰¹. Studies on the alkalinity of the water as affecting embrittlement are being continued¹⁰³. Aluminate of soda as a preventive of silica scale formation is urged by Christman⁸². Corrosion of condenser tubes is discussed by Houghton¹⁰². An electrical process depending upon counteracting potential developed in the boiler has been tried out in England¹⁰⁸.

Siems explains how the operating facilities of a small company were bettered by development of existing wells and metering the services¹³⁰.

Laboratory

At Denver, Colorado, it is possible to avoid the use of turbid water which would otherwise enter the intake on the South Platte river 23 miles from the city. A photoelectric cell is equipped to sound a warning and permit the discontinuance of the turbid water. It can be reversed to indicate when the period of turbidity is past⁵⁶.

Additional work on the influence of the hydrogen ion concentration on the formation and decomposition of **chloramines** is reported by Chapin⁸³. **Dissolved phosphorus and inorganic nitrogen** and their influence in fostering the growth of plankton has been studied by Wiebe at Fairport, Iowa¹⁰⁴. He arrives at the conclusion that in the Mississippi river there is plenty of inorganic nitrogen to support the plankton, but that deficiencies of dissolved phosphorus may restrict algae growth. Acidity of the Monongahela river increases the operating difficulties of the 22 water works plants which use the water. At one plant the **acidity** reached 142 ppm., calculated as negative alkalinity in terms of calcium carbonate⁵⁰. Tillmans and Hirsch have discussed neutralization of acid water in German⁷⁵.

Milwaukee's water supply in 1930 was the best in the city's history. It was better than the U. S. Treasury Department Standard required⁸. Los Angeles continues to be bothered by sea gull contamination of water in reservoirs¹³³.

R. L. Laybourn of the Laboratories of the Missouri State Board of Health has devised a new type of **water sample bottle** which he finds satisfactory for collection of bacteriological specimens¹³⁷.

The Drought

The lessons of the 1930 drought were very severe in some localities and earnest efforts are being made to profit by the information as to the required reservoir capacities. Foremost in this effort to secure more available water is New York City whose experience has been described by W. W. Brush¹²⁸ and others^{31, 49}. J. P. Laboon points out that the current **basic assumptions for water yield** must be revised immediately⁴⁴. West Virginia was one of the states which suffered most⁸⁹. Quick work was necessary in order to avoid shortage at San Francisco¹³¹. The **salinity** of tidal streams was increased in Maryland¹⁶⁴. Emergency equipment for chlorination of temporary water supplies was much in use as the cities in the drought areas turned to new and untried sources⁴⁵. The depleted condition of the ground water as a result of the

drought is such as to make it likely that streamflows fed in part by spring water will be low until the winter of 1931-1932^{58, 69}.

The drought of 1929 in Germany caused Dr. Karl Imhoff and other members of the staff of the Ruhrverband to study the number of times it was possible to pass through the cycle water-sewage-water. In 99 days they were able in their experiments to pass through eleven cycles. An acidity developed but was corrected with lime. The common salt could not be removed, however, and its concentration proved to be the determining factor which limited the number of cycles feasible⁶³. Fish died in the course of the work due to development of acidity but survivors were unaffected when the acidity was controlled. In England drainage from the tarred roads has been found to be toxic to fish, but the toxicity is not of a high order.

Swimming Pools

Trends in swimming pool sanitation point to insistence upon better and better operation of purification equipment and control according to F. R. Shaw²⁹. Supervision of pools in Hartford¹⁶ and in Wilmington, Delaware⁹⁸, has secured satisfactory operation. Painting the walls of concrete pools with cement paint is described by Waples¹⁹.

New York's newest pool is the Bronxdale outdoor pool¹⁷. Several new pools have been built abroad. In this group are included the Bristol South Baths¹⁰⁵, the Westminster Public Baths¹⁰⁷, and the Hallenschwimmbad-Ost at Frankfurt a.M.-Fechenheim⁷⁷. New York's new Jones Beach State Park provides a recreation area on Long Island^{5, 18}. Safety for those who swim on any of Los Angeles' beaches is safeguarded by a special corps of life savers assigned to districts¹².

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* The Three Leading Articles.

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161. Drought Caused Increased Salinity of Tidal Streams of Maryland, Anon., p. 132.

162. Cost of Laying New 48 Inch Main at New Bedford, Mass., Anon., p. 136.

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Expert Blasting on Highway Job

(Continued from page 21)

which sublet the grading and paving to the Swanger Co. The latter company's superintendent, H. A. Gettys, has been in highway and railroad construction work for thirty years, and the credit for the success of this job is chiefly his.

This difficult rock cut was performed in connection with lowering the old highway 30 feet and paving the new location with a 30-foot width of concrete, for a stretch of more than 400 lineal feet. The plan of procedure devised by Mr. Gettys was as follows: A channel 20 feet wide was excavated to a depth of 16 feet, leaving a wall along the outer edge about 10 feet thick to protect the railroad from falling material. After the blasted material had been cleaned out of this channel, the slope above it was shot down into the channel, the wall left on the outer edge preventing the loosened material from sliding on down onto the railroad. When the slope had been cleaned to grade, this outer wall was very carefully worked in toward the channel until it had been removed down to grade. The process was then repeated for a second cut, carrying the excavation down to the sub-grade level.

The rock was used in making fill at each end of the job. The excavation was completed in 109 working days with three 1½-yard gas shovels, loading into eleven "International" trucks (with wooden bottoms in the steel dump bodies to protect them from rocks). Blasting used 27,000 pounds of Atlas 40 per cent Giant gelatin dynamite and 12,000 electric blasting caps. Most of the dynamite was used in mud-capping the large boulders to be used in the fill.

Treating Meat Packing Wastes

(Continued from page 26)

The plant is completely manned by three men, and two more are required to handle the sludge.

Although we do not at the present time have accurate data concerning the cost of operation, preliminary surveys indicate that the value of the sludge, figuring nitrogen at market value, will pay for the cost of the chlorine, cost of operation, including labor and power, and interest and depreciation on the plant at the rate of 12%.

The practical application and control of the chlorination process at the Hormel plant was developed by W. L. Savell, technical adviser of the Mathieson Alkali Works, who, with Professor H. O. Halvorson of the University of Minnesota, is a joint inventor of a modified process calling for the use of sulphuric acid and chlorine successively. The Mathieson technical staff worked out all details of the chlorinating control equipment, and method of chlorine application, including the specification of design, materials of construction and application of special Bourdon tube vacuum chlorine-gauge for controlling the flow of chlorine. An interesting phase of the treatment is that part of the sewage is over-chlorinated and used to chlorinate the balance, thus keeping dilution of the sewage to a minimum. The practicability of this method of treatment was demonstrated under Mr. Savell's personal supervision in conjunction with the chemists of the Hormel organization.

The above article is reprinted, by permission, from "The National Provisioner," official organ of the Institute of American Meat Packers.



J. V. N. Dorr



Edwin L. Oliver

Union of Dorr Company and Oliver United Filters, Inc.

John Van Nostrand Dorr and Edwin Letts Oliver have announced a union of the businesses and assets of The Dorr Company and Oliver United Filters, Inc. This union was brought about on June 1st by the formation of a new company, to be known as Dorr-Oliver Corporation, under the joint management of Messrs. Dorr and Oliver.

Dorr-Oliver Corporation will function through its two, wholly-owned operating units, a new Dorr Company, Inc., and a new Oliver United Filters, Inc. Mr. Dorr and Mr. Oliver will head their respective companies and with the aid of their present executive and technical staffs, will continue on behalf of Dorr-Oliver Corporation, the businesses which they have individually initiated, organized and expanded so successfully in the past.

The businesses of the two uniting companies are of long standing and complementary. The Dorr Company occupies a leading position in the fields of agitation, classification and sedimentation through its equipment, built up around the original inventions of its founder, John V. N. Dorr; and the Oliver United Filters, Inc., occupies a similar position in the field of filtration through the inventions of Edwin L. Oliver and E. J. Sweetland. The union should, therefore, make it possible to offer to industry a more complete line of equipment and engineering service than either company could hope to offer individually. The fields are related so closely from a technical standpoint that the joint use of technical information and the carrying on of joint research and development is expected to result in more effective development and improvement of the equipment and processes which they have contributed to industry.

Both companies have built up tech-

nical staffs and manufacturing facilities at strategic locations throughout the world for the carrying on of their businesses which have grown to international proportions. The common use of these established facilities should give fuller, prompter and more efficient service to clients.

The two companies have frequently cooperated on the same projects, and, in many instances, the equipment of both is used at different stages of operation in the same plant. The founders of both companies have enjoyed a friendship extending over almost a quarter of a century and the long acquaintance of many members of the staffs has prepared them for effective cooperation effort.

J. V. N. Dorr

Mr. Dorr was educated at private schools and Rutgers University, New Brunswick, N. J. His degrees are B. Sc., Rutgers University, 1894; Eng. M., (Honorary), Rutgers, 1914; D. Sc., (Honorary), Rutgers, 1927.

He began his professional career as a Chemical Experimenter with Thos. A. Edison 1888-90, and was assayer, chemist, operator, research worker in South Dakota from 1895 to 1900; consulting metallurgist, designer and operator mills and mines, 1901 to 1913; founder and president Dorr Co., Engineers, 1913 to present. He invented the Dorr Classifier, Dorr Thickener, Dorr Agitator and many modifications of these used in metallurgical, chemical, industrial and sanitary fields.

Mr. Dorr was awarded the John Scott Medal of Franklin Inst., 1916, "For his hydrometallurgical apparatus extensively used in the cyanide (gold and silver extraction) process," and the James Douglas Medal of Amer. Inst. of Mining & Metallurgical Engineers 1929 for "his invention of apparatus and achievement in developing and improving hydrometallurgical practice." His long list of professional associations include: United Engineering Trustees, President 1931; Mining & Metallurgical Society of America; American Inst. of Chemical Engrs., Vice Pres. 1931; American Inst. of Mining & Met. Engrs.; American Electro-Chemical Society; Inst. of Mining & Metallurgy, London; Canadian Inst. of Mining & Metallurgy; So. African Chemical, Metallurgical & Mining Society. He is a trustee of Rutgers University and National President of the Zeta Psi fraternity.

Edwin Letts Oliver

The career of Edwin Letts Oliver, as a metallurgical engineer, and manufacturer, began definitely in 1900 when he completed his course in mining engineering at the University of Cal-

ifornia. He began work in cyanidation, after spending several years in surveying work and in other work connected with the mines of other fields. During this period he designed and supervised the construction of two cyanide slime plants of the North Star Mines Company, and was metallurgist for it until 1910. About 1908 he invented the Oliver Continuous Filter for handling cyanide slimes. Impressed with the favorable outlook for the filter manufacturing business, he resigned his place with the North Star Mines Company and embarked upon the manufacture and sale of the Oliver filter for cyanide slime plants in 1910.

Meeting with success, the filter was rapidly adapted to use in similar problems in other industries. A great impetus was given to the filter business by the newly exploited flotation process, just before the World War broke out in Europe, and soon the numerous war-born activities extended the use of the filter into industrial chemical fields. This adoption for other work received early recognition by a gold medal and awards at the Pan-American Pacific Exposition in 1915.

Beet-sugar manufacture was the next great industry to adopt the Oliver filter generally, and in 1917 an office was established in New York to care for increasing business.

Extension of the filter to handling sewage sludge in 1923-24 was soon followed by its wide adoption in various phases of paper manufacture. Since then, other uses for it have been proven, such as for salts and crystals and for the cane sugar industry. From the original simple type, the filter now embraces several hundred different combinations of type and size for the wide range of industrial filtration problems, and the many special patented modifications thereof are evidence of Mr. Oliver's skill in supplying the answer to problems in technique.

In 1928 a consolidation took place between the Oliver Continuous Filter Company, and the United Filter Corporation, which were the two most widely known manufacturers of filters, forming Oliver United Filters, Inc., of which Edwin Letts Oliver is President and active head.

Distinction in University work brought him election to the honorary scientific society, Sigma XI, and Sigma Gamma Epsilon, while his university conferred on him the honorary degree of Engineer of Mines. For many years Mr. Oliver has been a working member of "A. I. M. & M. E.," "The Mining and Metallurgical Society," "The Chemical Mining and Metallurgical Society of South Africa" and others; as a non-academic appointive member he has served for years on administrative boards for his own university.

As an undergraduate, he became a member of Delta Upsilon.

His home has always remained in California, where he was married and where his family of four children were born and educated.

Merger of the International Derrick and Equipment Company and the Stacey Engineering Company, of Ohio, which operates the P. H. and F. M. Roots company and the Connersville Blower Company plants, into a new company to be known as the International Stacey Corporation has been announced. Headquarters of the new company will be in Columbus, Ohio. E. D. Johnston, former president of the P. H. & F. M. Roots company, will continue in the capacity of member of the Board of Directors of the Stacey Engineering company. George W. Ansted, who for many years has been a member of the Board of Directors of the Connersville Blower Company, Inc., has been elected to the Board of Directors of the Stacey Engineering company.

J. S. Tatman, president and general manager of the Connersville Blower Company, Inc., and the P. H. & F. M. Roots Company, will continue in active charge of those companies.

It is understood that the properties will be known as the Roots-Connersville-Wilbraham Division of the International Stacey Corporation, and will also operate the Dayton Pump & Blower Division.

Engineering Societies

American Water Works Association

The 51st annual convention of the American Water Works Association was held at Pittsburgh, Pa., May 25 to 29. It was one of the most successful conventions ever held; the attendance was good, and the papers and discussion of high quality. Though some of the sessions dragged out somewhat, the majority of them kept pretty well to scheduled time. Ross L. Dobbin, General Manager, Utilities Commission, Peterborough, Ont., Can., was elected president to succeed George H. Fenkel, of Detroit, and W. W. Brush was re-elected treasurer. Beekman C. Little is secretary.

The social events were an attractive side of the convention. These began with the dinner of the "Service des Eaux" on Monday evening. Col. Bartow brought back old memories by showing a number of slides illustrating scenes overseas. Tuesday evening was the annual dinner of the Purification Division, which was as successful and interesting as ever. There were also dances, bridge and golf events. At the annual dinner and dance held Thursday evening in Pirate Hall, the golfers were more than prominent by their uniformly deep red hue.

New York State Sewage Works Association

The spring meeting of the New York State Sewage Works Association was held at the municipal building, Freeport, N. Y., June 5-6, 1931. One hundred seventy-five members, guests, wives and manufacturers were registered. At the business meeting a brief announcement was made regarding two annual awards to be known as the Kenneth Allen Memorial awards for excellence in technical papers and for excellence in annual reports on plant operation.

The technical session in the morning was devoted to two comprehensive papers, one on "Present and Future Status of Sewerage and Sewage Treatment on Long Island" by A. F. Dapert, Assistant Sanitarian, New York State Department of Health, the discussion on which was opened by C. A. Holmquist, Director of the Division of Sanitation, New York State Department of Health; and the other on "Sanitary Engineering in a County Health Department" by R. E. Cook, Sanitary Engineer, Suffolk County Health Department. Discussion on the latter paper was opened by J. L. Barron, Sanitary Engineer, Westchester County Department of Health.

At the Round Table discussion in the afternoon, Earle B. Phelps opened the discussion on "What a Sewage

Plant Operator Should Know"; Morris Cohn on "What Sewage Tests Can the Small Plant Operator Make?"; John F. Skinner on "Advantages and Disadvantages of Covered Drying Beds," illustrated with large charts and photos; Horace H. Chase on "Advantages and Disadvantages of Covered Settling Tanks"; Weston Gavett on "Gas Collection from the Digestion of Activated Sludge at Rockville Center."

More than twenty manufacturers had exhibits on display which were excellently set up, and unusual interest was shown by those attending the meeting.

The Saturday morning inspection trip to the pumping stations and sewage treatment works of the villages of Freeport, Rockville Center and Garden City was most instructive owing to the varied problems and methods of treatment.

The next meeting of the association will probably be held in Ithaca in mid-October.

American Road Builders' Association

The 29th annual Convention and Road Show of the American Road Builders' Association will be held in Detroit, January 9 to 15, 1932.

The Detroit Airport building will be used for both the convention and the road show. All exhibit space is on the ground floor and the arrangement makes possible the setting of the largest equipment without difficulty.

A new plan of housing delegates will be followed this year. An effort will be made to house all road builders whose interests are alike in the same hotel, city people in one hotel, county in another, Pan-American in still another and so on through the list. This plan will facilitate locating people at their hotels.

Headquarters hotels will be the Statler and the Book-Cadillac. Division headquarters will be maintained at these hotels. Hotel accommodations for delegates will be better than ever before.

All convention meetings will be held on the second floor of the Airport building where commodious and quiet rooms are available. Four convention rooms will be in use continuously throughout the convention to care for the many division meetings.

Personal Mention

Weston E. Fuller and Chester M. Everett announce the formation of a partnership under the name of Fuller and Everett. Mr. Fuller was a part-

ner in the firm of Hazen and Whipple from 1908 to 1915 and in the firm of Hazen, Whipple & Fuller, from 1915 to 1922. Mr. Everett has been a partner in the firm of Hazen & Whipple and its successors since 1914, and in the firm of Hazen & Everett since 1929. Fuller & Everett have taken over the business of Hazen & Everett and will carry it on without change in policy. Leroy N. Babbitt, partner in Hazen & Everett, retired May 1, 1931.

George F. Fish, formerly commissioner of Public Works of Buffalo, N. Y., has opened offices at 557 Ellicott Square, Buffalo, N. Y., for the practice of engineering. He will specialize in paving and municipal problems.

Robert Cramer has removed his consulting engineering office to larger quarters at 647 West Virginia St., Milwaukee, Wisc.

Appointment of S. M. Smith as bridge engineer for the Missouri-Kansas-Texas Lines, effective June 1, has been announced. Mr. Smith will have charge of the completion of the Katy's new \$1,200,000 bridge across the Missouri river at Boonville, Mo., and other bridge and structure work on the railroad and succeeds R. M. Stubbs, who died suddenly several weeks ago.

The Truscon Steel Company of Youngstown, Ohio, announces the appointment of Garret A. Connors as Vice-President, Director of Purchases.

M. B. MacNeille has resigned from Fairbanks, Morse & Company and joined the Sales Organization of the Dayton-Dowd Company, manufacturers of centrifugal pumps, Quincy, Illinois, and will act as Western Sales Manager with headquarters in San Francisco.

Fairbanks, Morse & Co. has announced the appointment of R. H. Bacon, former advertising manager for the company, as manager of the Pump Sales Division with headquarters in Chicago.

C. C. Neale, of the Toledo Scale Company, Toledo, Ohio, has been elected President of The National Scalemen's Association. R. F. Mehl, Superintendent of the Division of Physical Metallurgy of the Naval Research Laboratory has been appointed Assistant Director of Research of the American Rolling Mill Company, Middletown, Ohio. He will be in charge of the physical science department of the Armco laboratories, and will take up his new responsibilities September 1st. He has been one of the Research consultants for this company for the past eighteen months.

Edgar Boyd Kay, former dean of the School of Engineering of the University of Alabama and former chief of the Hydraulic and Sanitary Division, Quartermaster's Office, U. S. A., died at Washington, D. C., recently. He was 71 years old. Mr. Kay had been engaged in private practice as a consulting engineer in Washington for some time.

7

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INDUSTRIAL LITERATURE

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It is a good practice to check this list regularly because descriptions of new bulletins are always being added.

Construction Methods and Equipment

Accessories, Motor Truck

1. Truck accessories—winches, power take-offs, derricks, special bodies, earth boring machines, and trailers of all capacities are described in a series of folders issued by the Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Asphalt Heaters

2. A 54-page booklet issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates oil, wood and coal burning asphalt and tar kettles, tool heaters, sand dryers, tool boxes, traffic line markers, grout mixers, asphalt tools and their use in road construction. 9. "Hotstuf," the master oil burning heater, is the only heater with patented elevated melting chamber for Asphalt, Tar and all bitumens used in road and street construction and maintenance, roofing, water proofing, pipe coating, etc. Described in illustrated manual No. 11—Mohawk Asphalt Heater Co., 94 Weaver St., Schenectady, N. Y.

Asphalt Plants

10. J. D. Farasey Mfg. Company, Cleveland, Ohio, issue a booklet for use and specifications for Farasey Portable Asphalt Paving Plants. These R. R. 1-car plants have easy capacity of 2,250 yards, 2" surface per 8 hours. Cheap to operate.

Asphalt Rollers

12. A 16-page booklet printed in two colors gives full details and specifications of the Erie Roller. Also explains how to use it to save tamping costs. Numerous action pictures. Issued by the Erie Machine Shops, Erie, Pa.

Clamshell Buckets

27. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Clamshell Buckets showing the various types, sizes and uses for which they are intended and construction features and other valuable bucket information. A complete catalog on all types of Clamshell Buckets will also be furnished on request.

Concrete Accelerators

30. "How to Cure Concrete," a forty-seven page manual published by the Dow Chemical Company, Midland, Michigan,

treats fully the subjects suggested by its title. A well-illustrated and instructive volume.

31. "Curing Concrete Roads with Solvay Calcium Chloride," 30 page booklet. Comprehensive. Contains tables, illustrations, suggestions for testing devices. Covers the subject in considerable detail. Published by the Solvay Sales Corp., 61 Broadway, New York, N. Y.

35. "A report on Current Practice of using Calcium Chloride for curing Concrete Pavements, Building Construction, Bridges, Culverts and Concrete Products." Concise practical data, embodies latest information on subject. Issued by Columbia Products Co., Barberton, Ohio.

Concrete Mixer

44. Jaeger Concrete Mixers, both Tilting and Non-Tilting types, from $3\frac{1}{2}$ to $3\frac{1}{2}$ size, with illustrated descriptions of all types mounting, power and loading equipment—64 pages published by The Jaeger Machine Company, Columbus, Ohio.

Crushers

56. Pioneer Gravel Equipment Manufacturing Company, Minneapolis, Minnesota, publishes complete 80-page manual, showing blue print sketches of set-ups in pit or quarry of the eleven different sizes of Pioneer Crushing Plants.

57. Up-to-date information on Stone Crushers, Stone Spreaders, Unloaders, Drags and other contractors' equipment from the Galion Iron Works & Mfg Co., Galion, Ohio.

Culverts—Large Diameter

59. The Toncan Culvert handbook, containing 56 pages of typical Toncan Culvert installations and much valuable data pertaining to all kinds of drainage problems, will be gladly sent free upon request. Address Toncan Culvert Mfrs. Assn., Massillon, Ohio.

60. Ease and speed of installation, economy, a full-width roadway and durable, maintenance-free service, are listed in the new catalog, "Armc Large Diameter Corrugated Pipe," as the advantages following the use of larger diameter culverts in meeting small bridge requirements. Catalog No. 8 will be sent free on request. Address Armc Culvert Mfrs. Association, Middleport, Ohio.

Drag Lines

61. Write for complete catalog on Pioneer Drag Line. Catalog shows cross section of Drum Unit with full description of Frame, Sheaves, Motor and Bucket.—Pioneer Gravel Equipment Mfg. Co., Minneapolis, Minn.

Dump Wagons, Steel

70. Steel Dump Bodies and hydraulic hoists for Fords and other small trucks

are described and fully illustrated in technical literature published by the Wood Hydraulic Hoist and Body Co., 7924-60 Riopelle St., Detroit, Mich.

71. "Steel Dump Bodies." Full data on steel dump bodies for every type of hauling proposition and description of special "Self-Dumper Bodies" for road Builders. Wood Hydraulic Hoist and Body Co., 7924-60 Riopelle St., Detroit, Mich.

Finishing Machine

75. Complete description of Lakewood Finishers, showing use of single and tandem screeds and tamper attachment for high speed production on concrete and bituminous pavements, city streets and highways—32 pages published by The Lakewood Engineering Company, Columbus, Ohio.

Graders

76. Elevating Graders. Two publications by the Caterpillar Tractor Co., Peoria, Ill., illustrate the Caterpillar Sixty Grader with and without engine.

Excavating Buckets

80. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Excavating Buckets showing the various types, sizes and uses for which they are intended and construction features and other valuable bucket information. A complete catalog on all types of Excavating Buckets will also be furnished on request.

Hoists, Truck

85. "Dump Truck Hoist." Double the Truck's value by using power operated Hydraulic Hoists. Catalog of WOOD Hydraulic Hoist and Body Company, Detroit, Michigan, describes Hydraulic Hoists for every make and model of Truck.

Hose and Belting

87. Complete information on rubber hose and belting for all types of contracting and road building service available from the Government Sales Department of the Goodyear Tire & Rubber Co., Inc., Akron, Ohio.

Lanterns and Torches

90. Send for interesting catalog in colors of Dietz Lanterns and Road Torches adapted for night traffic warning on any construction work that obstructs the highways. R. E. Dietz Co., 60 Laight St., New York, N. Y.

91. An illustrated folder in two colors has just been printed describing the Toledo Torch for illuminating hazards on highway and other construction. Issued by the Toledo Pressed Steel Co., Toledo, Ohio.

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USE THE COUPON ON THE BOTTOM OF PAGE 83

92. "Setting a New Standard of Torch Efficiency" is the title of a new folder giving full details concerning specifications of the Cleveland Flaming Torch. Includes illustrations of the special burner. Just issued by the Consolidated Iron-Steel Mfg. Co., 1290 E. 53rd St., Cleveland, Ohio.

Loaders and Unloaders

96. Portable car unloaders save money for the contractor on road and other construction projects. Full information on this and on the Reliance Chip and sand spreader on request. Universal Road Machinery Co., Kingston, N. Y.

97. Link-Belt Company, Philadelphia, describes a line of Portable Loaders and Unloaders in Folders: Nos. 1073 and 1074 cover Belt Conveyors with channel iron and truss types of framework; No. 1076, Portable Bucket Elevators for different classes of work; and No. 1149, the "Grizzly" Crawler Loader for heavy work and large capacities.

100. Link-Belt Co., Chicago, Ill. General Catalog No. 500, describing the entire line of Link-Belt Materials Handling and Positive Power Transmission Equipment, giving technical data, list prices and illustrations of this machinery.

Motor Trucks

106. "Operating Trucks Profitably in Contracting"—A 24 page survey with practical data on efficient truck operation and what to consider in selecting new equipment just published by General Motors Truck Company—Pontiac, Mich.

107. The new "Operating Record for Motor Trucks" just issued by Dodge Brothers Corp., Detroit, Mich., is one of the most complete record books available. It includes the necessary forms and directions for a very accurate and detailed accounting of Motor Truck operations.

108. Four-wheel-drive trucks to increase the range of truck operation and for economy of operation for use in road building and maintenance, described in a series of new folders just issued by the Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Paving Materials

109. A 36 page booklet with 66 illustrations has just been issued by the Barrett Co. giving full information regarding the making, laying and maintaining of "Tarvia-lithic," the ready-to-lay pavement.

111. "Tarvia Double Seal Pavements." Shows, step by step, the construction of a Tarvia pavement. Profusely illustrated with photographs, 24 pages. The Barrett Company, 40 Rector Street, New York.

Plows

112. Plows, Grade Rippers (Scarifiers) and Scrapers are fully illustrated in a new catalogue which will be sent upon request by Wlard Plow Company, Batavia, N. Y. Oldest Plow manufacturers in America.

Power Graders

117. A large wall display piece, No. 3101, printed in three colors and containing a very large illustration of the WARCO Model "E" power grader as well as complete description and working views on center control graders will be sent by the W. A. Riddell Co., of Bucyrus, Ohio, to anyone interested.

Pumps, Contractors'

122. Humdinger contractors' pumps. Diaphragm pumps in both the open discharge and the diaphragm force pump types. Self-priming Centrifugal pump, for automatic continuous prime on suction lifts up to 28'. Are described fully and valuable practical information for contractors is given in special Bulletins #107-A and 1034. Ralph B. Carter Co., 53 Park Place, New York, N. Y.

Road Construction

123. "Road Construction and Maintenance" are covered in a new Cletrac Booklet, which takes up such subjects as modern methods of handling large ca-

pacity equipment, tandem equipment, etc. Cleveland Tractor Co., 1932 Euclid Ave., Cleveland, Ohio.

124. Building Roads Better, Cheaper and Quicker. A book by the Caterpillar Tractor Co., Peoria, Ill., telling how smooth, well-built roads can be built better, cheaper and quicker. It pictures the machines which do this work, and tells how the machine's economy, dependability and stamina are important.

Road Rollers, Scrapers, Graders, etc.

125. Plows, Grade Rippers (Scarifiers) and Scrapers are fully illustrated in a new catalogue which will be sent upon request by Wlard Plow Company, Batavia, N. Y. Oldest Plow manufacturers in America.

126. Illustrated catalog and descriptive material HERCULES All-steel, 6-cylinder road roller. 60 H.P. Gasoline engine. Sizes 5, 7, 8, 10, 12, and 15 tons. Three speeds forward and backward. Cast Steel rollers. The Hercules Company, Marion, Ohio.

127. A 16-page booklet printed in two colors gives full details and specifications of the Erie Roller. Also explains how to use it to save tamping costs. Numerous action pictures. Issued by the Erie Machine Shops, Erie, Pa.

128. A beautiful 32 page book in four colors featuring their entire line of road rollers has been published by the Buffalo-Springfield Roller Co. of Springfield, Ohio. 8 1/2 x 11, leatherette cover, numerous action pictures.

129. Caterpillar publications as follows: Sixty Leaning Wheel Grader, the Super-Special Grader, the Motor Patrols, the Twenty Planer, the Hi-Way Patrol Grades No. 3, the Ten Motor Patrol, and the Auto Patrol. These cover a wide range of valuable and useful information on road-building machinery. Caterpillar Tractor Co., Peoria, Ill.

131. 20-page pocket size booklet showing all types of Buffalo-Springfield motor rollers and scarifiers. The Buffalo-Springfield Roller Company, Springfield, Ohio.

132. "Road Machinery." A sixty-four page data book has been issued by the Austin-Western Road Machinery Company, 400 No. Michigan Ave., Chicago, describing their full line of road building machinery. Included in it are illustrations and descriptions of road graders, 5-foot blade to 12-foot blade; road rollers, steam or gasoline powered, 3 to 15-tons single cylinder to four cylinder. Motor graders, three sizes. Scarifiers. Crushing plant equipment, small road tools. Special bulletins on each separate piece of machinery supplement the general catalog.

133. "Road Rollers." New illustrated booklets covering the entire line of Master 4-Cylinder motor roller, 4-cylinder tandem roller and International motor roller. Galion Iron Works and Manufacturing Co., Galion, O.

134. 36-page, illustrated book describing mechanical features of Huber 4-cylinder Motor Roller and its application to many types of road construction and maintenance. Huber Mfg. Company, Marion, Ohio.

135. Road Machinery Illustrated. New illustrated bulletins on the master Motor Roller, Three-Wheel and Tandem Rollers, Motor Graders powered by Caterpillar, Twin City, Cletrac, McCormick-Deering and Fordson tractors, and Straight and Leaning Wheel Graders. Galion Iron Works & Mfg. Co., Galion, O.

136. Full description of Huber Motor Rollers in sizes from 5 to 15 tons, included in durable 36-page book for use by road contractors and maintenance crews. Huber Mfg. Co., 345 E. Center St., Marion, Ohio.

137. Road Machinery. Comparative specifications of the various types of equipment manufactured by the Caterpillar Tractor Co., Peoria, Ill.

Sand and Gravel Washing Plants

138. The Dorco Sand-Washer is inex-

pensive to install and operate, and produces a clean, drained sand with a minimum of waste. It will make separation at any point between 20 and 100 mesh. Ask for bulletin No. 4101. The Dorco Co., 247 Park Ave., N. Y.

139. Up to date information on Portable Sand and Gravel Washing Plants with concrete capacities, ranging from 30 to 100 yards per hour.—Pioneer Gravel Equipment Mfg. Co., Minneapolis, Minn.

Screens

140. Full information concerning Shaker and Revolving Screens, Conveyors, Elevators, Bins and Chutes is contained in catalog and special illustrated folders on Pioneer line. Write Pioneer Gravel Equipment Mfg. Co., Minneapolis, Minn.

Shovels, Cranes and Excavators

142. The Cranemobile, "successor to Trench Cranes," an adaptation of the crawler mounted Bay City Tractor Shovel is fully described and illustrated in Bulletin C2 just issued by Bay City Shovels, Inc., Bay City, Mich.

145. Catalog K just issued, completely describes the light half yard and the full half yard convertible shovel, crane, dragline, trench hoe and skimmer manufactured by Bay City Shovels, Inc., Bay City, Mich. 28 pages, over 50 illustrations, action pictures and charts.

146. Link-Belt Co., Chicago, Ill., has issued Book No. 1095, which describes and illustrates their complete line of Gasoline, Electric, or Diesel operated shovels, cranes and draglines.

151. The complete line of 1/2-yd. to 1 1/2-yd. shovels, cranes, draglines, ditchers and skimmers manufactured by the Orton Crane & Shovel Co., 608 S. Dearborn St., Chicago, Ill., is described in Bulletin 60, which also gives lifting capacities and working ranges for the different sizes and types of these crawling tread machines.

Steel Forms

155. A well illustrated catalog of Steel Forms for concrete road, curb and sidewalk construction is available from The Heitzel Steel Form & Iron Company, Warren, O.

Steel Bins

159. Steel bins and measuring hoppers are included in a fully illustrated catalog of Contractors Equipment issued by The Heitzel Steel Form & Iron Company, Warren, Ohio. Write for your copy.

Steel Posts

160. Steel Posts for all purposes. Sweet's Herculean Steel Posts for highway guard rails, fences and other purposes. Catalog and data book. Sweet's Steel Company, Williamsport, Pa.

Tires, Truck and Car

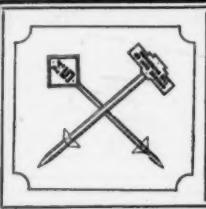
165. Solid, cushion and pneumatic tires and tubes for trucks, cars, tractors, graders and other road machinery. Full information and data available from Government Sales Department of the Good-year Tire & Rubber Company, Inc., Akron, Ohio.

Tractors, Crawlers

168. "High Clearance," "Caterpillars in Mines, Quarries, Clay Plants and Pits," "The Caterpillar for Industry," "The Caterpillar for Railroads," "For the Earth Mover," are publications of the Caterpillar Tractor Co., Peoria, Ill.

169. Cletrac crawler tractors. Cleveland Tractor Co., 1932 Euclid Ave., Cleveland, O. Bulletin 562 describes their use in roadbuilding and maintenance, earth moving, excavating, grading, snow removal, oil field work and lumbering. Made in "20," "30," and "40" and "100" sizes.

170. "Roads," a series of five fully illustrated folders, prepared by the Caterpillar Tractor Co., of San Leandro, Calif., and Peoria, Ill., shows what Russell graders and "Caterpillar" tractors can do and are doing to build better roads quicker and cheaper.

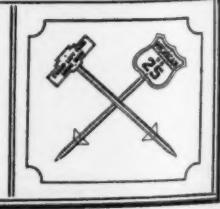


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STEEL POSTS





Rex Moto-Mixer

Rex Designs for the Future in Truck Mixers

New methods of handling concrete, new methods of selling the mixed batch and new methods of financing concrete factories has played an important part in the design of Rex Moto-Mixers. Believing that the equipment designed today for dry plants, wet plants, or shrinkage plants must be planned to pay its way profitably for the next several years, Rex engineers have taken obsolescence seriously into consideration.

Water has received a great deal of attention by the designers of Moto-Mixers. Every precaution was taken to see that the water control mechanism be as accurate and as fool-proof as possible. Once the control is set for the right amount of water the system remains accurate.

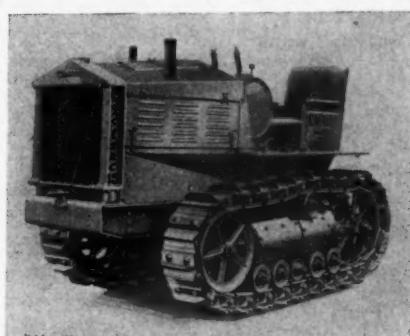
A new controlled discharge has been developed that makes discharging very easy. The operator can direct the flow of concrete at will. A new spout is also used to help place the mixed concrete at a greater efficiency into forms. The discharge is made much higher. Allowance has been made so that the mixed batch can be discharged into various forms or on various jobs at a greater range.

The entire batch can be discharged regardless of the angle of the truck which has delivered the mixed batch to the job. The Moto-Mixer was engineered to discharge the mixed concrete even though the incline is exceedingly steep. The Moto-Mixer is lighter and lower than any of its previous models. It has a separate mounting. The reduction gears are of heat treated steel and are enclosed in a bell housing and operate in a constant bath of oil. The mixer itself can be mounted in any type of truck or trailer.

Equipment for the Construction Field

The Cletrac "15"

Cleveland Tractor Co., Cleveland, O., announce their new model tractor, the "15." Despite its low price and small size, this new tractor has lots of power. Already numerous sales have been made where it is pulling 5-foot fresnoes on excavating and leveling work. In other cases, these little



Cletrac "15"

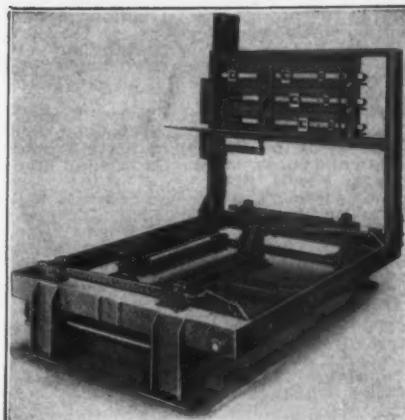
tractors are being used by cities, counties and townships on maintenance work. Speed is from 1.95 to 4.37 miles per hour.

New Fairbanks Skip Mixer Scale

To facilitate accurate proportioning of concrete aggregates, as demanded by law in most states for state construction work, and as generally specified by structural engineers, Fairbanks, Morse and Co. has recently made available to contractors a new Fairbanks Skip Mixer Scale designed to eliminate guess-work in concrete construction.

The Fairbanks skip mixer scale consists of an all-steel welded frame and beam box in which is mounted a specially designed Fairbanks knife edge lever scale with swiveled arm connections. The scale is equipped with three ingredient beams made of non-corrosive metal graduated 1500 lbs. by 2 lbs., each of which is furnished with both a main and a fractional poise. There is also a tare for balancing the weight of the skip. These beams are enclosed in a steel beam box with doors on both sides, either one or both of which may be opened for operation and secured with a padlock when not in use; or the poises may be set by an inspector and locked.

Materials are dumped into the skip from wheelbarrows. No trimming of



Fairbanks Mixer Scale

the wheelbarrow load is required and only the last load of any particular ingredient requires care in dumping. The over and under indicator gives plenty of evidence when the beam is approaching balance so that the last load can be dumped in slowly and stopped at the proper point. The operation is the same for the other ingredients, each beam being released in turn by pulling a trigger on the outside of the beam box. The ingredients are then ready to be hoisted into the skip and discharged into the mixer.

For Handling Sand, Gravel, Concrete, Etc.

The Fairfield Engineering Company, Marion, Ohio, has recently issued a bulletin, Number 40-1, which gives complete and detailed information concerning Fairfield Portable Belt Conveyors and their application.

Fairfield Portable Belt Conveyors in sizes from 20 to 60 feet are being used extensively for handling a wide variety of materials including sand, gravel, crushed stone, mixed concrete, steel scrap, grain, Agricultural limestone and cinders.

They are furnished with belt widths of 20 in. and 24 in. and can be equipped with electric or gasoline power units as preferred.

The new bulletin describes the application of Belt Conveyors, their proper usage as well as gives pertinent information that is of interest to every user of conveyors.



Fairfield Portable Belt Conveyor

USE THE COUPON ON THE BOTTOM OF PAGE 83

171. The design, construction, details and complete specifications of the new Ten and Fifteen models "Caterpillar" are given in a booklet recently published by the Caterpillar Tractor Co. of San Leandro, Calif., and Peoria, Ill.

172. The Caterpillar Sixty Tractor. This beautifully illustrated booklet tells the story of the Caterpillar Sixty Tractor design and construction. Caterpillar Tractor Co., Peoria, Ill.

173. Cletrac Crawler Tractors are built in a complete line by The Cleveland Tractor Company, 19322 Euclid Ave., Cleveland, Ohio. Cletracs range in size from the 12 h. p. model to the powerful 100 h. p. tractor.

Tractors, Wheel

175. "Huber Tractors" and "The Huber Motor Rollers." Illustrations of machines in operation and testimonials from users. The Huber Mfg. Co., 345 E. Center St., Marion, Ohio.

Truck Cranes

182. Full-revolving, gasoline-operated Truck Cranes with a capacity of 7½ tons at a 10 ft. radius, for mounting on a 5-ton or 7½ ton auto-truck, are described in Bulletin 62, issued by the Orton Crane & Shovel Co., 608 S. Dearborn St., Chicago, Ill.

Truck Hoists

183. "Dump Truck Hoists." Double the Truck's Value by using power operated Hydraulic Hoists. Booklet published by WOOD Hydraulic Hoist and Body Company, 7924 Riopelle St., Detroit, Michigan, describes Hydraulic Hoists for every make and model of Truck.

Wheeled Scoops

190. The WARC O wheeled scoops, claimed to offer the most economical handling of earth on short hauls, is fully described and illustrated in Bulletin No. 3102 issued by the W. A. Riddell Co., of Bucyrus, Ohio. Printed in three colors and fully illustrated—will be sent to anyone interested.

Road and Street Maintenance

Asphalt Heaters

201. Tar and Asphalt Kettles, Oil Burning Kettles, Pouring Pots, Torches and Hand Spraying Attachments. Full data. Connelly & Company, Inc., of Philadelphia.

202. Connelly & Company, Inc., 3900 N. Second St., Philadelphia, Pa., has issued a new Bulletin "J" describing the latest and improved style "J" Oil Burning Kettle for Paving Contractors, Street and Highway Departments.

203. A 54-page booklet issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates oil, wood and coal burning asphalt and tar kettles, tool heaters, sand dryers, tool boxes, traffic line markers, grout mixers, asphalt tools, etc.

Dust Control

210. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with dust control, road building and maintenance. It contains tables and composition, grading, etc.

211. "Dust Control," a concise, handy pocket reference on control of dust by use of 3C Calcium Chloride. Illustrated. Issued by the Columbia Products Company, Barberton, Ohio.

Dust Laying

213. Solvay Sales Corporation, New York, supplies full information regarding the use of Solvay Calcium Chloride for effectively laying dust. The booklet, "Solvay Calcium Chloride, a Natural Dust Layer," 24 pages, 5½x8, covers application, economics, etc. Sent without cost.

Equipment

215. "Road and Street Maintenance Equipment," a compact vest pocket manual containing illustrations and brief descriptions of their extensive line, has just been issued by Littleford Bros., 452 East Pearl St., Cincinnati, Ohio.

216. "Light and Heavy Road Maintenance" is the title of a recent folder showing the tremendous power developed by the FWD truck and its economy for use in pulling road graders and maintainers—issued by the Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Surface Heaters

218. The new "Hotstuf" three in one, combination Tool, Asphalt and Surface heater is fully described and illustrated in Bulletin 16 just issued by the Mohawk Asphalt Heater Co., 56 Weaver St., Schenectady, N. Y.

Road and Paving Materials

Asphalt Plank

220. The Philip Carey Company, Cincinnati, Ohio, has available a handsome booklet describing Elastite Asphalt Plank for Bridge Flooring—with specifications for use—liberally illustrated with photographs.

Brick, Paving

230. Full information and data regarding the use of vitrified brick as a paving material may be obtained from the National Paving Brick Manufacturers' Association, National Press Building, Washington, D. C.

Concrete Curing

235. "How to Cure Concrete," is a manual of instruction on the curing of concrete pavements. A handy, useful volume, well illustrated. 47 pages, 5½x7½. The Dow Chemical Company, Midland, Mich.

Culverts, Corrugated

236. The Toncan Culvert handbook, containing 56 pages of typical Toncan Culvert installations and much valuable data pertaining to all kinds of drainage problems, will be gladly sent free upon request. Address Toncan Culvert Mfrs. Assn., Masillon, Ohio.

Culverts—Corrugated Metal

238. A new 24-page, well-illustrated catalog, listing the advantages that follow the use of Armcoc corrugated iron culverts and containing complete instructions for ordering and installation has been published by Armcoc Culvert Mfrs. Association, Middletown, Ohio. Write for Culvert Catalog No. 6.

Expansion Joint for Pavements

250. Premoulded Expansion Joints in several different types, including a new asphalt rubber joint, in order to meet various construction conditions are covered in literature issued by the Servicised Premoulded Products, Inc., 53 W. Jackson Blvd., Chicago, Ill.

251. Full information on the use of Expansion Joints in pavements, bridges, pools, walls and other concrete work, including best installation methods, may be obtained from The Philip Carey Company, Cincinnati, Ohio.

Jacking Method

260. No interruption to traffic, and substantial savings in construction costs are the main advantages secured by using the Armcoc jacking method to install conduits, drainage openings, and passageways under streets, highways and railroads. A new catalog, "The Armcoc Jacking Method," describing this modern means of construction and its many applications, will be sent upon request, by Armcoc Culvert Mfrs. Association, Middletown, Ohio. Ask for Catalog No. 7.

Maintenance Materials

267. "Mixed-in-Place Construction with Tarmac." Step-by-step pictures and specifications for constructing road surfaces by Retread or Turnover methods. American Tar Products Co., Koppers Bldg., Pittsburgh, Pa.

270. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with road building, maintenance and dust control. It contains tables of composition, grading, etc.

272. "Asphalt for Every Purpose," a 44-page illustrated booklet describing Stanolind Asphalt products is now ready for distribution. Recently published by the Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

273. Complete directions for surface treatment and bituminous surfacing with Cut Back Asphalt are contained in a 36 page data book just issued by the Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

275. "Tarvia-K. P. for Cold Patching." An instructive booklet illustrating and describing each step in patching a road with "Tarvia-K. P." 16 pages, illustrated, 3½x9. The Barrett Company, New York.

276. "Road Maintenance with Tarvia." A 56-page illustrated booklet of value to every road man. Shows how almost every type of road and pavement can be repaired and maintained with Tarvia. The Barrett Company, New York.

277. "Tarvia." An attractively illustrated 32-page booklet describing grades of Tarvia and showing photographs of actual application. The Barrett Company, 40 Rector St., New York City.

278. Information regarding crack and joint fillers furnished in gray, black, or other colors, for poured joints, also maintenance and repair work may be obtained by application to the Servicised Premoulded Products, Inc., 53 W. Jackson Blvd., Chicago, Ill.

Material Handling Buckets

280. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Material Handling Buckets, showing the various types, sizes and uses for which they are intended and construction features and other valuable bucket information. A complete catalog on all types of Material Handling Buckets will also be furnished on request.

Rail Filler

281. Luminous Rail Filler used for sound deadening, rail insulation and pavement protection is described in pamphlet issued by Servicised Premoulded Products, Inc., 53 W. Jackson Blvd., Chicago, Ill.

282. Write to The Philip Carey Company, Cincinnati, Ohio, for complete and interesting data on the application of Elastite Rail Filler in Street Railway Tracks.

Sand and Gravel Buckets

290. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Sand and Gravel Buckets showing the various types, sizes and uses for which they are intended and construction features and other valuable bucket information. A complete catalog on all types of Sand and Gravel Buckets will also be furnished on request.

Garbage and Refuse Disposal

305. "Pittsburgh-Des Moines Incinerator," built and guaranteed by the Pittsburgh-Des Moines Steel Company, 3479 Neville Island, Pittsburgh, Pa., is described fully in a booklet sent on request.

Snow Removal

Snow Removal

348. "Winter Maintenance" is the title of a recent booklet issued by the Four Wheel Drive Auto Company, Clintonville, Wisconsin. Illustrates many types of snow plows and methods of handling snow removal problems.

349. "The Answer to the Snow Removal Problem" is the title of a new booklet just published by Carl Frink, Mfr., of Clayton, N. Y. It gives full details of the new Frink type S snow plow for trucks.

353. Efficient methods of combating quickly the snow menace on highways and city thoroughfares. Illustrates joint use of crawler tractors and standard and special snow plows. The Cleveland Tractor Co., 19322 Euclid Ave., Cleveland, Ohio.

354. "Snow Removal Equipment," a colorful booklet just off the press of the Caterpillar Tractor Co., of San Leandro, Calif., and Peoria, Ill. Various types of snow-fighting equipment built for "Caterpillar" Tractors are pictured in relief and in action.

355. "Conquering Snow With Caterpillars," "An Unwelcome Visitor Is Coming," "A Wall Ten Miles High." Three publications on the snow problem by the Caterpillar Tractor Co., Peoria, Ill.

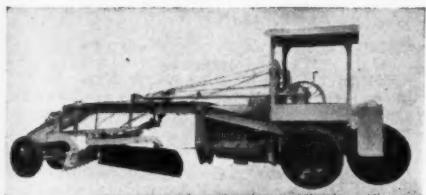
358. The new type "S" Frink Snow Plows and Frink Leveling Wings, together with complete data for selecting the proper size snow plow for your particular make and model of truck. Published by Carl H. Frink, Clayton, N. Y.

359. Calion Iron Works and Mfg. Co., Galion, Ohio, will gladly furnish details, prices and catalogs of their snow plows adaptable to any make of truck.

Late Developments in Engineering Equipment

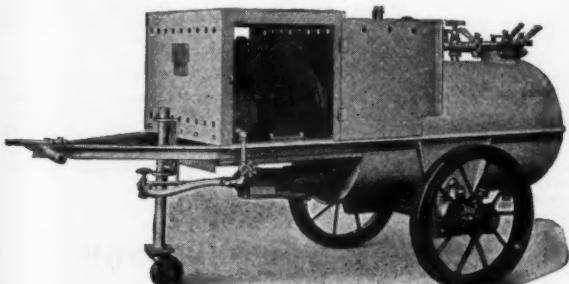
Rome Multi-Wheel Motor Grader

The Rome Multi-Wheel Motor Grader brought out recently by the Rome Mfg. Co., Rome, N. Y., represents advanced engineering in both design and construction. It is designed to eliminate slippage of wheels. The two wheels on the main axle and the two wheels on the auxiliary axle each travel on a different surface, each tire being in contact with the surface at a different point. By having each pair of wheels drive through a separate differential, should the pair of wheels driven through one differential lose traction and slip, the other pair of wheels will continue to drive and move the machine forward. The travelling speed of the unit is not reduced, and there is increased traction utilizing the full power of the McCormick-Deering Model 20 Industrial Tractor with which the unit is equipped. There is more power to the cutting blade, so that maximum results can be accomplished with the machine. The moldboard of the machine is extra wide and properly concaved so that it rolls



Rome Multi-Wheel Grader

the dirt, rather than scraping or pushing it, and is so curved as to free itself from dirt at all times. Ball bearings and Timken taper roller bearings are used throughout. The grader attachment has counter-balanced springs, ball-and-socket joints, cut gears running in oil in enclosed dust-proof gear cases, Alemite-Zerk lubrication, all of which contribute to the ease of operating and steering the machine. This machine is especially well adapted for retread work, where power, without reduction of speed, is essential.



Littleford Emulsion Distributor

New Bay City Trailer for Carrying Shovels

A new four-wheel trailer has been developed by Bay City Shovels, Inc., Bay City, Mich., primarily for the purpose of carrying Bay City $\frac{3}{8}$ -yard Tractor Shovels (ten-ton weight), as well as Bay City Model K revolving shovel (14½-ton weight). This trailer is constructed with an electric welded frame made up of 12-inch steel ship channels; wheel base is 15 ft. 1 inch, and over-all width 8 ft. making it possible to use this trailer on all state highways without special permit. Tires are 28 inches diameter, 12 inches face. Heavy duty rubber tire wheels are equipped with Timken bearings.

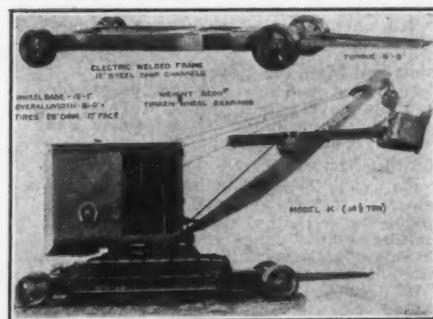
Bay City shovels can be loaded on this trailer in eight minutes' time. This is not simply an extra wheel arrangement for bolting under a machine, but is a complete trailer which not only can be used for Bay City equipment, but for handling any other shovels, cranes or contractors' equipment up to 14 tons in weight.

While developed primarily to provide Bay City machine owners with a low priced trailer for their equipment, the sale of it will not be limited to Bay City owners.

Air-Pressure Distributor for Emulsions

Littleford Bros. Co., Cincinnati, O., have announced Unit 93-AM, a motor driven air-pressure distributor, which will spray any type of asphalt emulsion that is used for penetration patch work or curing concrete. It will also handle light road oils and can be used to excellent advantage in the application of such materials on bituminous pavements.

Simplicity of operation is an important advantage of this emulsion distributor. Easy operation is absolutely essential to any machine that is to be used successfully by road construction



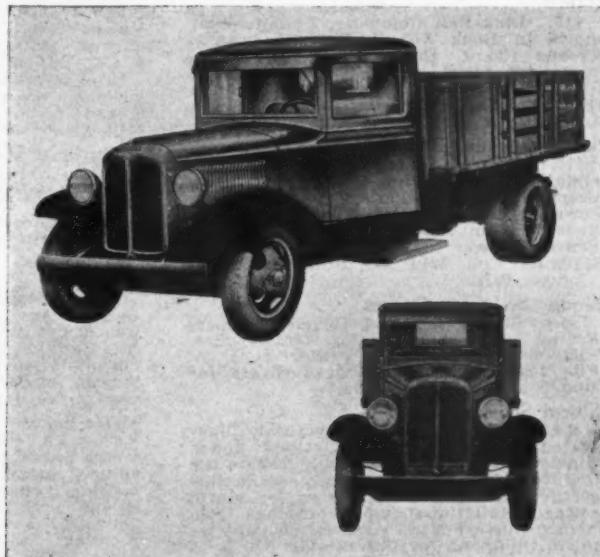
The Bay City Four-Wheel Trailer for Shovels.

and maintenance gangs—a factor that was kept constantly in mind when the No. 93-AM Emulsion Spray was being designed.

Reo Announces New 1½-Ton Speed Wagons

Pictured below is one of the new Reo one and one-half ton Speed Wagons powered by either four or six cylinder engines which are being offered in the lowest priced field. It shows many features associated heretofore only with trucks in the thousand dollar and above price class. Among these may be mentioned larger crankshafts supported by maximum number of bearings having more liberal bearing areas, large piston displacements to provide ample power, extra deep frames, large hydraulic brakes in the interest of safety at high speed, cam and lever steering, heavy duty transmission designed for truck service and full floating axles.

The full-floating rear axles of the new one and one-half ton Speed Wagons were especially designed for dualing,



The New Reo Speed Wagons

Sewerage and Sewage Disposal

Activation and Aeration

390. A new booklet describing Norton Porous Mediums of bonded fused alumina (strong, chemically stable, uniformly permeable), the booklet will be of interest to all chemical and sanitary engineers. Issued by Norton Co., Worcester, Mass.

Inlets and Manhole Covers

400. Cast iron sewer blocks, ventilators, manhole covers and inlets, valves, etc., described in pamphlet by the South Bend Foundry Co., South Bend, Ind.

Jointing Materials

401. G-K Compound for vitrified clay sewers, MINERALEAD for bell and spigot water mains, also M-D Cut-Ins for making house connections, described in catalogue of Atlas Mineral Products Company, Mertztown, Pennsylvania.

402. An illustrated folder has just been issued by the Cochrane Chemical Co., 432 Danforth St., Jersey City, N. J., detailing the advantages and the savings in the use of Ex-XX-cell Sewer Pipe Joint Compound.

403. A recent publication of the Servicized Sales Company, Monadnock Block, Chicago, Illinois, tells of the superior tightness, flexibility and durability of fibrated asphalt Sewer Pipe Belts and Joint Compounds. Complete instructions and considerable data are included in the pamphlet, now available.

Sewer Joint Compound

404. Full details concerning No. 1 Korite for sealing sewer pipe joints so that they will be permanently tight are contained in an illustrated folder just issued by the Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

Pipe, Vitrified

405. Full information regarding Vitrified Pipe and other heavy clay products. Illustrated price list on application. Factories in Pennsylvania and Ohio. The Progressive Clay Co., offices in New York City, Philadelphia, Pa., and Syracuse, N. Y.

Pumps—Sewage

410. Non-clog vertical and horizontal sewage pumps are fully described and illustrated in new bulletins just issued by the Dayton-Dowd Co., Quincy, Ill.

Sewage Pumps

411. Full information regarding sewage pumps is given in publication 210, and a large number of sewage pump installations are illustrated and described in publication 193. The American Well Works, Aurora, Ill.

Sewage Screens

414. The Dorr Co., 247 Park Ave., N. Y., publishes Bulletin No. 6391, which describes the construction and operation of the Dorco Mechanically-Cleaned Bar Screen.

415. Link-Belt Company, Philadelphia, shows in Book 642 its line of sewage screens (Tark, Brunotte, and Straightline) for fine and coarse sewage; Straightline Collectors for Settling Tanks (Sludge, Scum and Grit); and Mechanical Aerators for activated sludge plants.

Sewer Cleaning Machines

416. Illustrated booklet describing Adjustable Turbine Sewer Cleaners, Self-Propelling Ferret Turbines, Drag Type Sewer Cleaners, Five Types of Sewer Rods, Conduit Rods, Windlasses, Sewer Braces, Sewer Cables. Turbine Sewer Machine Co., 5210 W. State St., Milwaukee, Wisc.

Sludge Bed Glass Covers

418. Sludge Bed Glass Covers—"Super-Frame" Hitchings & Co., Main Office, Elizabeth, New Jersey. Offer A. I. A File 101SB. Describing glass covers for sludge and sprinkler beds.

Storm Sewers

424. A 24-page catalog, profusely illustrated with actual installations under widely varying conditions, which lists the features that give superiority to flexible corrugated metal construction for storm sewer installations, can be obtained from Armco Culvert Mfrs. Association, Middlebury, Ohio. As for the catalog No. 5.

423. The Toncan Culvert handbook, containing 56 pages of typical Toncan Culvert installations and much valuable

data regarding the use of Toncan Copper Molybdenum Culverts for economical and lasting storm sewers, drainage information, etc., will be gladly sent free upon request. Address Toncan Culvert Mfrs. Assn., Massillon, Ohio.

Treatment

425. Dorr Company, 247 Park Ave., New York, in its Sanitary Engineering bulletin describes the use of its equipment for treating municipal sewage, industrial wastes and water. Photos of numerous operating plants are shown as well as representative flow sheets illustrating the various methods of sewage treatment.

427. The Pacific Flush Tank Company, of Chicago and New York, publish eight separate catalogues on Sewer and Sewage Disposal Automatic Equipment, including pumps, Imhoff Tanks and Sewer Joint Compounds. These are of real value to the designer or operator of a treatment plant.

428. Advantages of Liquid Chlorine for disinfection given in booklet issued by the Electro Bleaching Gas Co., 9 East 41st St., New York.

429. Chlorine is being extensively used in the disinfection of sewage not only as a disinfectant but as an aid to other purification processes. Wallace & Tiernan Co., Inc., Newark, N. J., have a publication, No. 42, on the chlorination of sewage, which will be sent to any address on request.

430. The Dorr Co., 247 Park Ave., N. Y., publishes Bulletin No. 6171, which describes the treatment of sewage with Dorr Traction Clarifier, an improved type of continuous sedimentation for use in water and sewage treatment plants.

432. The Dorr Company, 247 Park Ave., N. Y. C., publishes Bulletin No. 6431, which describes the construction and operation of the Dorr Detritor for continuously removing and washing the grit from sewage flows.

434. Automatic, continuous vacuum filters, producing a relatively dry cake of sludge in demand for fertilizer, are used by: Milwaukee, Houston, Chicago, Gastonia, N. C., Charlotte, N. C., write for literature. Oliver United Filters, Inc., Federal Reserve Bank Bldg., San Francisco, Calif.

Water Works Equipment

Activation and Aeration

465. A new booklet describing Norton Porous Mediums of bonded fused alumina (strong, chemically stable, uniformly permeable), the booklet will be of interest to all chemical and sanitary engineers. Issued by Norton Co., Worcester, Mass.

Couplings and Tees

485. Copper pipe for water works services and patented connections for jointing to corporation stops, iron pipe, etc. Full data 22 pages 8 1/2 x 11. The Mueller Co., Decatur, Ill.

505. "Mathews" Fire Hydrants, Gate Valves and other water works appurtenances. 16 pages, 7 1/2 x 10%. R. D. Wood & Co., Philadelphia.

506. Hydrants, tapping apparatus, gate locks, valves and curb cocks described in a series of bulletins issued by A. P. Smith Mfg. Co., East Orange, N. J.

Jointing Materials

515. MINERALEAD for bell and spigot water mains, G-K Compound for vitrified clay sewers, also M-D Cut-Ins for making house connections, described in catalogue of Atlas Mineral Products Co., Mertztown, Pa.

Meters

520. "Niagara and American Water Meters are described in the 36-page catalog issued by Buffalo Meter Co., 2920 Main St., Buffalo, N. Y. Catalog describes the chromium-shell gear train, patented frost bottom, ultra-simple design and other exclusive features."

Meter Boxes

526. An illustrated catalog covering meter boxes and specialties such as gate valve housing, curb boxes, meter testers, melting furnaces, jointing materials, four-in-one pumps, has recently been published by the Hydraulic Equipment Co., Reading, Pa.

Pipe, Cast Iron

534. "Sand-Spun," Centrifugal cast iron pipe manufactured by R. D. Wood & Co.,

Philadelphia, is fully described in a valuable 16-page 6x9 booklet, containing also complete specifications of this pipe. No engineer or water works official should be without this booklet.

535. Cast Iron Pipe and Fittings, sizes 1 1/4 through 12 inches, either with or without Precaulked lead joints factory-made in the bells. Data book sent free. The McWane Cast Iron Pipe Co., Birmingham, Ala., and Provo, Utah.

536. "Weights and dimensions of Cast Iron Pipe and Fittings." A handy reference book for Municipalities and Contractors. 48 pages, 7 1/2 x 10%. R. D. Wood & Co., Philadelphia.

539. U. S. Cast Iron Pipe Handbook contains useful tables and data for the Water Works man on pipe line construction. Issued by U. S. Cast Iron Pipe and Foundry Company, Burlington, N. J.

Pipe, Cement Lined

540. Steel or Wrought Iron Pipe lined with cement and special lead-lined joints, manufactured by the Cement Lined Pipe Co., of Lynn, Mass.

Pipe for Subdrainage

549. The benefits following the use of Armco perforated iron pipe for various municipal uses such as golf course, athletic field, and airport drainage; and its various applications in the construction and maintenance of highways and railroads are outlined in the 24-page illustrated catalog entitled, "Armco Perforated Iron Pipe." Catalog No. 4 is obtainable upon request from Armco Culvert Mfrs. Association, Middletown, Ohio.

Pumps, Waterworks

560. Centrifugal pumps for high or low service pumping for waterworks and filtration plants. Bulletins contain interesting installation photos, characteristic curves, etc. Dayton-Dowd Co. Mfrs. Centrifugal Pumps, Quincy, Ill.

Pumps

561. Double suction centrifugal pumps are described in Bulletin 197; multi-stage centrifugals in Bulletin 200; deep well turbines in Bulletin 211, and a number of municipal pump installations in Bulletin 178. These contain much valuable data. Free on request. The American Well Works, Aurora, Ill.

Pump Packing

575. "When Power Is Down," by the Sterling Engine Company, Buffalo, N. Y., gives recommendations of models for standby services for all power requirements.

Screens

576. Link-Belt Co., Chicago, Ill., has issued Book No. 1252, which describes their Water Screens and gives complete technical information about them.

Service Boxes

578. "Service Boxes with Stay-on Covers. No more broken covers. No more lost covers." (Booklet). The Central Foundry Company, 120 Lexington Avenue, New York, N. Y.

Swimming Pools

580. Wallace & Tiernan Co., Inc., Newark, N. J., have just published a new edition of technical publication, No. 41, dealing with the sterilization of swimming pools by liquid chlorine. Copy sent on request.

Tanks and Stand Pipes

582. A 50-page booklet issued by Pittsburgh-Des Moines Steel Co., 3479 Neville Island, Pittsburgh, Pa., on complete water works plants, elevated tanks, stand pipes and filtration plants built by them.

Tapping and Valve Machines

583. The A. P. Smith Company, of East Orange, N. J., furnish descriptive matter dealing with their many labor saving devices as the Smith tapping machine, valve inserting machine and pipe cutting machines.

Valves

585. Catalog covering our line of Bronze and Iron Valves for service on Steam, Water, Gas, Gasoline, Air and Oil lines furnished upon request. Also data on "Dart" Unions and Fittings. The Fairbanks Company, 393 Lafayette Street, New York, N. Y.

Miscellaneous

Airport Construction

595. Airports and Airways. A 20-page illustrated booklet by the Caterpillar

A New Auto Truck Crane

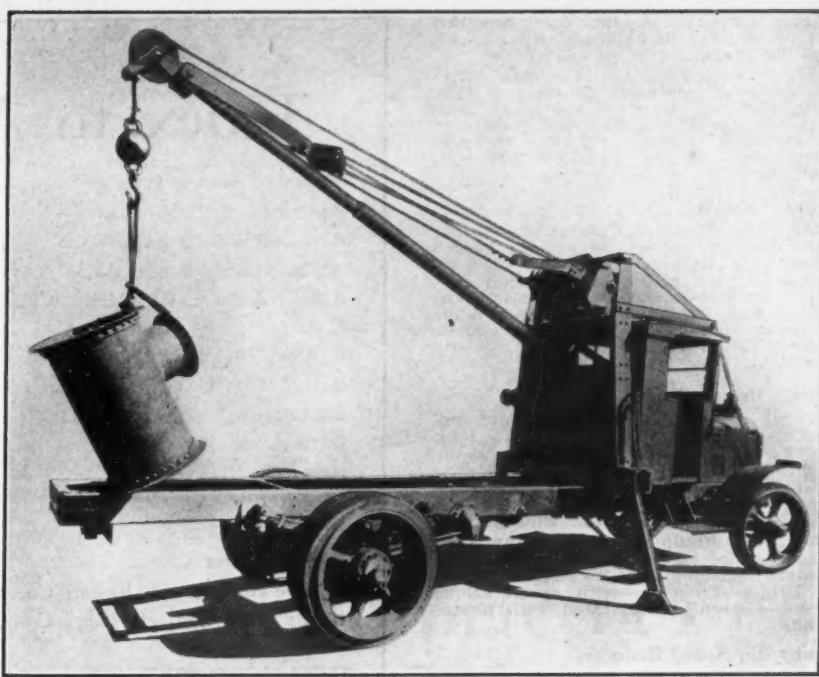
The Howard Auto Truck Crane is manufactured by the New York Engineering Company, 75 West Street, New York, N. Y. It is made in three sizes, 4000 lbs., 8000 lbs. and 12000 lbs. capacity. The boom is adjustable from twelve to fifteen feet. It can be raised or lowered and can swing through an arc of 180° by power. Lattice channel booms are provided on the two larger sizes.

Because these operations as well as the load itself are power driven in each direction through powerful worm and gear reduction, the load cannot be dropped and no brakes are required.

The advantages of a crane of this type in taking only 12 inches of space back of the cab are apparent. It can load other trucks, distribute its own load, be used for stacking curbing, manholes and other material saving yard room.

Niggerhead can be provided as an extra. With snatch block two speeds are given; or the snatch block can be hooked at the rear of truck and material brought up from basements, etc.

Both plants of the New York Engineering Company are located in Yonkers, N. Y.



The Howard Auto Truck Crane Has Wide Utility

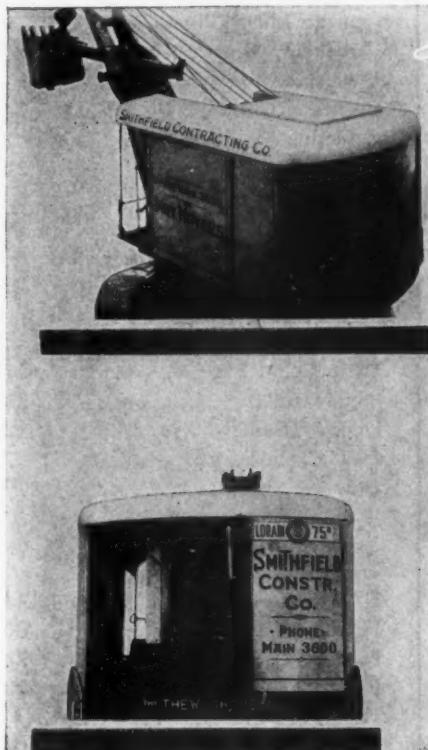
Lufkin "Crescent" Tape-Rule

A 6-foot measure, combining in a unique way the convenience of a pocket tape and the utility of a rule, has just been brought out by the Lufkin Rule Co., Saginaw, Michigan. It is known as the "Crescent" Tape-Rule and is unlike any other article on the market. It is an accurate Steel Tape that automatically winds into a sturdy case only 2" in diameter, yet, when withdrawn, is rigid like a rule. "Crescent" No. 696 is marked inches to 16ths; No. 696D is marked feet, 10ths and 100ths of feet, i.e., engineers' measure.

The line or rule blade is of super quality tempered steel, stiffened by special forming. It is nickel plated and has prominent dark markings. Unsupported, it may be projected like a rule. It will also flex around and accurately measure circular, round-cornered and other shaped objects.



Convenient for All Measuring



How the new Lorain Cab looks.

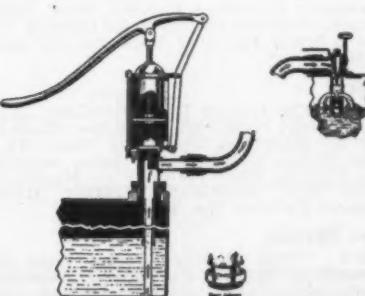
Lorain 6 Point Cab

A new, smart looking cab containing many unusual features, that contribute both to the efficiency and comfort of the operator, has been announced by the Thew Shovel Co., Lorain, O., as standard equipment on their complete line of Lorain shovels and cranes. It is known as the Lorain 6-Point Cab, as it offers six distinct advantages—appearance, accessibility, visibility, ventilation, protection and safety.

New Pump Makes Refueling Easy

A new pump for refueling tractors, trucks, power shovels and other gasoline-operated equipment has been placed on the market by the Air-Way Pump Company, 625 W. Jackson Blvd., Chicago, Illinois. The pump attaches quickly and rigidly to a barrel or drum by means of a bung adapter. The pipe extending into the barrel can be telescoped from 20 to 35 inches, making the pump adaptable to barrels of various depths. It is provided with a bulb shaped strain-fuel tank. By operating the pump handle air is forced into the container causing the liquid to flow directly through pump chamber and out. The air cushion created over the liquid causes an even and steady flow.

A combination indicator and valve screws on the outer end of the hose. This device is provided with a spring catch to prevent the hose pulling from the tank opening. It registers when the tank is full, and has means for shutting off the liquid flow.



The Air-Way Refueling Pump.

USE THE COUPON ON THE BOTTOM OF PAGE 83

Tractor Co., Peoria, Ill., describes the uses of tractors in building airports and handling planes.

597. "Getting on the Air Map With 'Caterpillar,'" profusely illustrated with action pictures, describes the many uses of the tractor in building and maintaining airports better, quicker, cheaper. Caterpillar Traction Co., San Leandro, Calif., and Peoria, Ill.

Airport Drainage

599. The Toncan Culvert handbook, containing 56 pages of typical Toncan Culvert installations and much valuable data pertaining to the use of Toncan Perforated Iron Drains and Culverts for economical and permanent drainage of landing fields, will be sent free upon request. Address Toncan Culvert Mfrs. Assn., Massillon, Ohio.

Asphalt Bridge Planking

600. A new and improved asphalt composition has been developed as a long wearing and resilient paving material for bridges, viaducts, railroad platforms, etc., covered by Catalog No. 12, now available from Servicised Premoulded Products, Inc., 58 W. Jackson Blvd., Chicago, Ill.

601. The Philip Carey Company, Cincinnati, Ohio, has available a handsome booklet describing Elastite Asphalt Plank for Bridge Flooring—with specifications for use—liberally illustrated with photographs.

Chains and Speed Reducers

607. Link-Belt Co., Indianapolis, Ind., gives full description of its positive drives in books. No. 125 Silent Chain; No. 1257, Roller Chain; No. 815, Herringbone Speed Reducers; No. 1050, Promal Chains. Send for these positive power transmission books.

Community Advertising

610. Booklet showing various forms of publicity matter useful in arousing interest in the construction of small town water supplies. This matter is furnished free to Consulting Engineers and towns interested in waterworks construction by The Cast Iron Pipe Research Association, 568 Peoplez Gas Bldg., Chicago, Ill.

Flexible Joints

611. Bulletin 204 containing 60 illustrations gives complete data regarding uses and specifications of Barco flexible joints for water works, sewage disposal plants, road contractors pipe lines, etc. Just issued by the Barco Mfg. Co., 1800 Winnemac Ave., Chicago, Ill.

Highway Crossings

612. A most serviceable and durable railroad crossing for city streets and main highways, is composed of fibrated asphalt planking and rail filler sections. Complete description and data will be furnished by Servicised Premoulded Products, Inc., 58 W. Jackson Blvd., Chicago, Ill.

Miscellaneous

618. Pipe Lines and the Caterpillar. In this 32-page booklet are pictured many uses of the Caterpillar Tractor, and ways in which they can be applied to the saving of men, money and minutes. The Caterpillar Tractor Co., Peoria, Ill.

Municipal Drainage Products

620. A complete line of drainage products which meets the modern municipal need for drainage materials that are quickly installed, safe, and dependable and economical in service is described in the new 24-page, illustrated catalog, "Armclo Municipal Drainage Products." A request to Armclo Culvert Mfrs. Association, Middletown, Ohio, for Catalog No. 9 will bring you this book free of obligation.

Rules

625. The Lufkin Rule Company, Saginaw, Mich.; New York; Windsor, Canada. Manufacturers of Measuring Tapes, Boxwood Rules, Spring Joint Rules, Straight and Folding Steel Rules, Fine Mechanics Tools and Aluminum Folding Rules. General Catalog No. 11.

Tree Moving

632. "Tree Moving," folder from the Caterpillar Tractor Co., of San Leandro, Calif., and Peoria, Ill., shows and tells with action pictures and the letters of landscaping experts how to successfully move large trees.

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